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1959

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FOREWORD

THE THREE-VOLUME Minerals Yearbook for 1959 is being issued in this, the 50th anniversary year of the Bureau of Mines. Although the Bureau of Mines was established in 1910, the Minerals Yearbook is much older, having appeared originally in 1867 as "Reports Upon the Mineral Resources of the United States" under the seal of the Department of the Treasury. Over the years, the series has appeared variously as "Mineral Resources West of the Rocky Mountains," as part of the "Annual Report of the Geological Survey," and as "Mineral Resources of the United States." Under the last-named title, the series first appeared under Bureau of Mines authorship. That was in 1927 and the statistical coverage was for the year 1924.

In 1933, the publication assumed its new and present title of "Minerals Yearbook." Beginning with the 1952 edition, the presentation became a three-volume issue to meet the expanded and specialized needs of the mineral industries and others.

The three-volume issues of the Yearbook follow this pattern: Volume I includes chapters on metal and nonmetal mineral commodities except mineral fuels. In addition, it includes a chapter reviewing these mineral industries, a statistical summary, chapters on mining and metallurgical technology and employment and injuries, and a new chapter on technologic trends.

Volume II includes chapters on each mineral fuel, an employment and injuries presentation, and a mineral-fuels review chapter that summarizes developments in the fuel industries.

Volume III contains chapters covering each of the 50 States, plus chapters on island possessions in the Pacific Ocean and the Commonwealth of Puerto Rico and island possessions in the Caribbean Sea, including the Canal Zone. Volume III also has a Statistical Summary chapter, identical with that in Volume I. and a chapter on employment and injuries.

The data in the Minerals Yearbook are based largely upon information supplied by mineral producers, processors, and users, and acknowledgment is made of this indispensable cooperation given by industry. Information obtained from individuals through confidential surveys has been grouped to provide statistical aggregates. Data on individual producers are presented only if available from published or other nonconfidential sources, or when permission of the individuals concerned has been granted.

MARLING J. ANKENY, *Director*

ACKNOWLEDGMENTS

In preparing this volume of the MINERALS YEARBOOK, the Bureau of Mines was assisted in collecting statistical data and mineral-industry information by State agencies, through cooperative agreements. Many State chapters were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as coauthors. For this assistance, acknowledgment is made to the following cooperating organizations:

Alabama: Geological Survey of Alabama.
Alaska: Department of Mines.
Arkansas: Arkansas Oil and Gas Commission; Department of Revenue.
California: Division of Mines.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Geological Survey of Georgia.
Idaho: Bureau of Mines and Geology.
Illinois: State Geological Survey.
Indiana: Indiana Department of Conservation.
Iowa: Iowa Geological Survey.
Kansas: Conservation Division, State Corporation Commission; State Geological Survey, University of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Department of Conservation.
Maine: Geological Survey of Maine.
Maryland: Department of Geology, Mines, and Water Resources.
Michigan: Michigan Department of Conservation.
Mississippi: Mississippi State Oil and Gas Board; Oil and Gas Severance Tax Division, Mississippi State Tax Commission.
Missouri: Geological Survey and Water Resources.
Montana: Montana Bureau of Mines and Geology.
Nevada: Nevada Bureau of Mines.
New Hampshire: New Hampshire State Planning and Development Commission.
New Jersey: Bureau of Geology and Topography.
New York: New York State Science Service.
North Carolina: Geological Survey of North Carolina.
North Dakota: North Dakota Geological Survey.
Oklahoma: Oil and Gas Conservation Department, Oklahoma Corporation Commission; Gross Production Tax Department, Oklahoma Tax Commission.
Oregon: State Department of Geology and Mineral Industries.
Pennsylvania: Bureau of Topographic and Geological Survey.
Puerto Rico: Mineralogy and Geology Section, Economic Development Administration, Commonwealth of Puerto Rico.
South Carolina: Geological Survey of South Carolina.
South Dakota: State Geological Survey.
Tennessee: Tennessee Department of Conservation.
Texas: Oil and Gas Division, Railroad Commission of Texas; Oil and Gas Division, State Comptroller of Public Accounts.
Utah: Utah Geological and Mineralogical Survey.
Virginia: Division of Mineral Resources.
Washington: Division of Mines and Geology.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological Survey.
Wyoming: Geological Survey of Wyoming.

Except for the two review chapters, this volume was prepared by the field staffs of the five Divisions of Mineral Resources. The following supervised preparation of the chapters: Ottey M. Bishop, chief Division of Mineral Resources, Region I, Albany, Oreg.; Alvin Kaufman, chief, Field Office, Region I, Juneau, Alaska; W. F. Dietrich, chief, Division of Mineral Resources, Region II, San Francisco, Calif.; Alfred L. Ransome, acting chief, Division of Mineral Resources, Region III, Denver, Colo.; Robert S. Sanford, acting chief, Division of Mineral Resources, Region IV, Bartlesville, Okla.; G. W. Josephson, chief, Division of Mineral Resources, Region V, Pittsburgh, Pa.; Samuel A. Gustavson, chief, Field Office, Region V, Minneapolis, Minn.; and Avery H. Reed, Jr., chief, Field Office, Region V, Knoxville, Tenn. Preparation of this volume was supervised and the chapters were coordinated with those in volumes I and II by Donald R. Irving, assistant to the chief, Division of Minerals.

Statisticians and researchers in the Division of Mineral Resources who gave substantial assistance to the authors of the chapters were: In Region I, Clara M. Hutcheson (Albany); in Region II, Leo Giorgetti and Betty Tong (San Francisco); in Region III, Stella K. Drake, Mary Jelliffe, and Muriel Clark (Denver); in Region IV, Dorothy Underwood, Lorraine Collier, Betty Siggins, Lydia DeRuvo, and Lovenia Edwards (Bartlesville); in Region V, Michael E. Bursic, Victoria M. Dorchak, and Stephanie A. Dzienis (Pittsburgh), Martha E. Peeples and Mildred K. Rees (Knoxville), Marguerite H. Beahan, Richard J. Bishop, Estelle E. King, Don N. West, and Wanda J. West (Minneapolis).

The manuscripts upon which this volume is based have been reviewed to insure statistical consistency among the tables, figures, and text, between this volume and volumes I and II, and between this volume and those for former years, by a staff under the direct supervision of Kathleen J. D'Amico, assisted by Julia Muscal, Hope R. Anderson, Helen L. Gealy, Helen E. Tice, Dorothy Allen, Anita C. Going, and Joseph Spann.

Minerals Yearbook compilations are based largely on data provided by the mineral industries. Acknowledgment is made of the willing contribution both by companies and individuals of these essential data.

CHARLES W. MERRILL,
Chief, Division of Minerals.

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Statistical Summary of Mineral Production

By Kathleen J. D'Amico[1]

◆

THIS SUMMARY is shown in volumes I and III of this series on mineral production in the United States (including Alaska and Hawaii), its island possessions, the Canal Zone, and the Commonwealth of Puerto Rico, and on the principal minerals imported into and exported from the United States. For further details on production, see the several commodity and area chapters. A summary table comparing world and U.S. mineral production also is included.

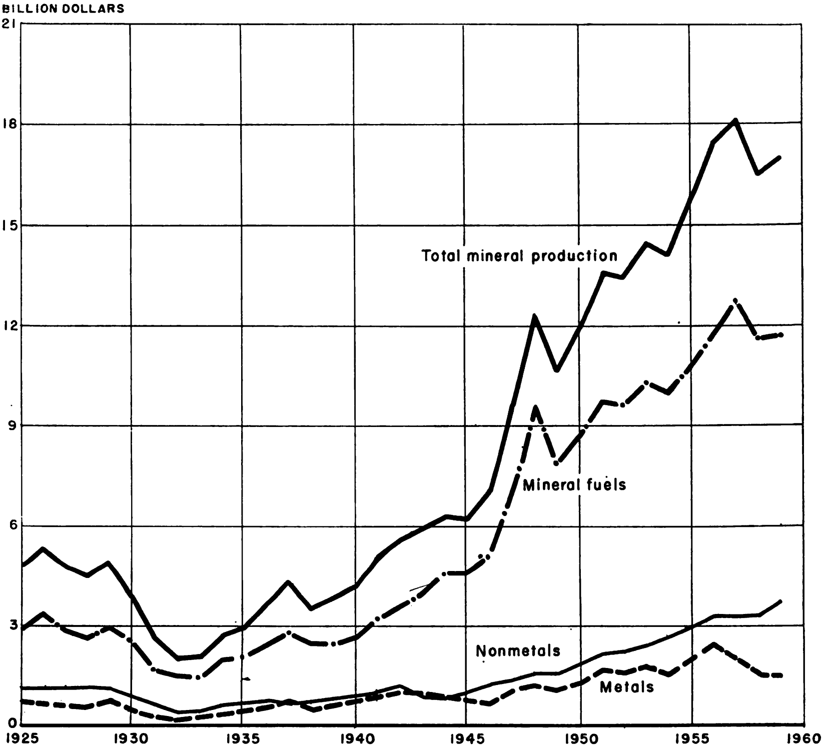

FIGURE 1.—Value of mineral production in the United States, 1925–59.

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[1] Publications editor.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in the chapter is normally what is termed "mine output". It usually refers to minerals in the form in which they are first extracted from the ground, but customarily includes for some minerals the product of auxiliary processing operations at or near mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. The quantities of gold, silver, copper, lead, zinc, and tin are recorded on a mine basis (as the recoverable content of ore sold or treated). The values assigned to these quantities, however, are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for metal.

Data for clays and stone, 1954–59, include output used in making cement and lime. Mineral-production totals have been adjusted to eliminate duplicating these values.

The weight or volume units shown are those customary in the particular industries producing the respective commodities. No adjustment has been made in the dollar values for changes in the purchasing power of the dollar.

TABLE 1.—Value of mineral production in the United States,[1] 1925–59, by mineral groups [2]

(Millions)

Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total	Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total
1925	$2,910	$1,187	$715	$4,812	1943	$4,028	$916	$987	$5,931
1926	3,371	1,219	721	5,311	1944	4,574	836	900	6,310
1927	2,875	1,201	622	4,698	1945	4,569	888	774	6,231
1928	2,666	1,163	655	4,484	1946	5,090	1,243	729	7,062
1929	2,940	1,166	802	4,908	1947	7,188	1,338	1,084	9,610
1930	2,500	973	507	3,980	1948	9,502	1,552	1,219	12,273
1931	1,620	671	287	2,578	1949	7,920	1,559	1,101	10,580
1932	1,460	412	128	2,000	1950	8,689	1,822	1,351	11,862
1933	1,413	432	205	2,050	1951	9,779	2,079	1,671	13,529
1934	1,947	520	277	2,744	1952	9,616	2,163	1,617	13,396
1935	2,013	564	365	2,942	1953	10,257	2,350	1,811	14,418
1936	2,405	685	516	3,606	1954	9,919	[3] 2,630	1,518	14,067
1937	2,798	711	756	4,265	1955	10,780	[3,4] 2,957	2,055	15,792
1938	2,436	622	460	3,518	1956	11,741	[3,4] 3,266	2,358	17,365
1939	2,423	754	631	3,808	1957	[4] 12,709	[3,4] 3,267	2,137	18,113
1940	2,662	784	752	4,198	1958	[4] 11,589	[3,4] 3,346	[4] 1,593	[4] 16,528
1941	3,228	989	890	5,107	1959	11,794	[3] 3,720	1,570	17,084
1942	3,568	1,056	999	5,623					

[1] Excludes Alaska and Hawaii, 1925–53.

[2] Data for 1925–46 are not strictly comparable with those for subsequent years, since for the earlier years the value of heavy clay products has not been replaced by the value of raw clays used for such products.

[3] Total adjusted to eliminate duplicating value of clays and stone.

[4] Revised figure.

TABLE 2.—Mineral production[1] in the United States

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
MINERAL FUELS								
Asphalt and related bitumens (native):								
Bituminous limestone and sandstone	1,458,533	$4,114	1,168,507	$3,221	1,326,493	$3,343	1,518,765	$3,868
Gilsonite	89,003	3,822	207,704	4,259	317,280	4,864	379,362	9,385
Carbon dioxide, natural (estimated)........thousand cubic feet	713,030	235	704,276	139	722,615	102	484,074	71
Coal:								
Bituminous and lignite[2]........thousand short tons	500,874	2,412,004	492,704	2,504,406	410,446	1,996,281	412,028	1,965,607
Pennsylvania anthracite........do	28,900	236,785	25,338	227,754	21,171	187,898	20,649	172,320
Helium........thousand cubic feet	266,937	4,413	310,365	5,112	352,134	5,741	375,408	6,144
Natural gas........million cubic feet	10,081,923	1,083,812	10,680,258	1,201,759	11,030,298	1,317,492	[3] 11,619,951	[3] 1,396,834
Natural-gas liquids:								
Natural gasoline and cycle products........thousand gallons	5,807,100	431,958	5,734,307	415,791	5,596,458	393,139	5,597,102	408,694
LP-gases........do	6,487,413	265,185	6,655,282	263,665	6,783,000	296,571	7,874,706	349,802
Peat	272,972	2,320	316,217	3,458	327,813	3,446	419,460	4,372
Petroleum (crude)........thousand 42-gallon barrels	2,617,283	7,296,760	2,616,901	8,079,259	2,449,016	7,380,065	[3] 2,574,590	[3] 7,476,369
Total mineral fuels	----------	11,741.000	----------	12,709,000	----------	11,589,000	----------	11,794,000
NONMETALS (EXCEPT FUELS)								
Abrasive stone[4]	(4)	363	(4)	331	(4)	[5] 182	(4)	315
Asbestos	41,312	4,742	43,653	4,917	43,979	5,127	45,325	4,379
Barite	1,299,888	13,498	1,145,791	12,897	605,402	7,510	901,815	10,301
Boron minerals	546,815	32,848	541,124	38,041	528,209	38,310	619,946	46,150
Bromine........thousand pounds	196,730	47,434	191,971	48,038	176,397	46,689	195,483	51,508
Cement........thousand 376-pound barrels	321,395	989,233	229,189	961,499	317,263	1,038,672	346,675	1,144,867
Clays........thousand short tons	50,775	163,048	45,620	155,805	43,750	143,487	49,383	159,659
Emery	12,153	174	11,893	184	7,687	126	8,555	150
Feldspar........long tons	560,074	5,829	498,057	4,935	469,738	4,278	548,390	5,213
Fluorspar	329,719	14,257	328,872	15,777	319,513	15,071	185,091	8,680
Garnet (abrasive)	9,812	1,073	9,776	1,080	[6] 12,303	[6] 869	14,568	1,211
Gem stones (estimated)	(7)	925	(7)	882	(7)	1,006	(7)	1,184
Gypsum........thousand short tons	10,316	34,099	9,195	29,871	9,600	32,495	10,900	[10] 39,231
Lime........do	10,567	135,532	10,266	135,143	9,203	[6] 120,921	12,498	163,890
Magnesite	686,569	2,502	678,489	3,258	492,982	2,409	594,307	2,401
Magnesium compounds from sea water and brines (except for metals)........MgO equivalent	169,019	13,668	184,236	15,997	207,053	16,419	276,309	21,636
Marl, calcareous (except for cement)	285,653	215	(8)	(8)	(8)	(8)	(8)	(8)

See footnotes at end of table.

TABLE 2.—Mineral production[1] in the United States—Continued

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS (EXCEPT FUELS)—continued								
Mica:								
Scrap	86,309	$1,850	92,438	$2,109	93,347	$2,065	99,941	$2,645
Sheet……pounds	887,871	2,757	690,052	2,492	[6] 661,344	[6] 2,845	706,395	3,419
Perlite	310,800	2,550	301,605	2,562	291,994	2,463	324,669	2,737
Phosphate rock……thousand long tons	15,747	97,922	13,976	87,689	14,879	93,693	15,869	98,758
Potassium salts……thousand short tons, K_2O equivalent	2,172	82,107	2,266	84,612	2,147	75,000	2,383	80,393
Pumice……thousand short tons	1,482	4,749	1,827	4,628	1,973	5,287	2,276	5,863
Pyrites……thousand long tons	1,070	9,743	1,067	9,087	974	7,987	(9)	(9)
Salt (common)……thousand short tons	24,206	136,139	23,844	148,887	21,911	141,486	25,160	155,839
Sand and gravel……do	631,495	602,412	632,255	599,750	[6] 684,498	[6] 652,789	[10] 730,205	[10] 728,712
Slate	645	11,666	632	11,029	(11)	(11)	(11)	(11)
Sodium carbonate (natural)	652,891	17,400	652,717	17,792	628,619	17,032	735,261	19,078
Sodium sulfate (natural)	332,990	6,437	331,382	6,542	347,445	6,716	402,743	7,689
Stone[12]……thousand short tons	504,031	763,313	532,791	814,373	[6] 535,923	[6] 826,685	584,163	911,982
Strontium minerals (crude)	4,040	77	(9)	(9)	(9)	(9)	(9)	(9)
Sulfur:								
Frasch-process mines……thousand long tons	5,676	150,356	5,035	122,915	4,644	109,272	5,222	121,777
Other mines……long tons	185,532	(9)	(9)	(9)	153,574	1,505	151,932	1,418
Talc, pyrophyllite, and soapstone	739,039	4,859	684,453	4,796	[6] 718,165	[6] 4,718	795,008	5,651
Tripoli	45,009	203	50,717	195	47,044	183	52,968	219
Vermiculite	192,628	2,543	183,987	2,603	[6] 190,564	[6] 2,728	206,579	3,082
Value of items that cannot be disclosed: Aplite, brucite, calcium-magnesium chloride, diatomite, epsom salts from epsomite (1956–57), graphite, iodine, kyanite, lithium minerals, greensand marl, nitrogen compounds (1957–59), olivine, staurolite (1957–58), sharpening stones (1956–58), wollastonite, and values indicated by footnote 9		35,033		37,086		[6] 39,765		50,470
Total nonmetals[13]		3,266,000		3,267,000		[6] 3,346,000		3,720,000
METALS								
Antimony ore and concentrate……antimony content	590	(14)	710	(14)	716	(14)	688	(14)
Bauxite……long tons, dried equivalent	1,743,344	$13,973	1,416,172	$12,868	1,310,685	$11,898	1,700,235	$17,725
Beryllium concentrate……gross weight	445	231	521	276	463	238	328	171
Chromite……do	[15] 207,662	[15] 8,715	166,157	7,816	143,795	6,187	[16] 105,000	[16] 3,765
Cobalt (content of concentrate)……thousand pounds	3,657	(14)	4,123	(14)	4,832	(14)	2,944	(14)
Columbium-tantalum concentrate[17]……pounds	216,606	(14)	370,483	(14)	428,347	981	189,263	(14)
Copper (recoverable content of ores, etc.)	1,104,156	938,532	1,086,859	654,289	979,329	515,127	824,846	506,455
Gold (recoverable content of ores, etc.)……troy ounces	1,827,159	63,950	1,793,597	62,776	1,739,249	60,874	1,603,802	56,133

Iron ore, usable (excluding byproduct iron sinter) thousand long tons, gross weight	96,944	750,354	104,157	865,703	[6] 66,288	[6] 569,154	59,164	514,067
Lead (recoverable content of ores, etc.)	352,826	110,787	338,216	96,730	267,377	62,566	255,586	58,786
Manganese ore (35 percent or more Mn) gross weight	344,735	26,990	366,334	29,363	[6] 327,309	[6] 23,637	229,174	17,903
Manganiferous ore (5 to 35 percent Mn) do	680,651	3,984	865,127	(14)	520,601	3,532	470,271	3,146
Manganiferous residuum do	130,129	(14)	(14)	(14)	(14)	(14)	(14)	(14)
Mercury 76-pound flasks	24,177	6,284	34,625	8,552	38,067	8,720	31,256	7,110
Molybdenum (content of concentrate) thousand pounds	57,126	63,901	57,143	67,605	42,328	50,371	51,603	64,655
Nickel (content of ore and concentrate)	7,392	(14)	12,901	(14)	13,489	(14)	[10] 13,374	(14)
Rare-earth and thorium concentrates	(14)	(14)	3,079	653	2,021	286	1,143	206
Silver (recoverable content of ores, etc.) thousand troy ounces	38,722	35,044	38,165	34,541	34,111	30,872	31,194	28,233
Tin (content of ore and concentrate) long tons	------	------	------	------	------	------	50	60
Titanium concentrate:								
Ilmenite gross weight	735,388	14,199	782,975	21,802	565,164	11,152	637,263	12,106
Rutile do	12,065	1,749	10,644	1,544	1,863	210	8,648	877
Tungsten ore and concentrate 60-percent WO_3 basis	14,737	51,201	5,520	8,186	3,788	3,991	3,649	4,502
Uranium ore	3,003,590	70,601	3,682,543	81,181	5,178,315	116,397	6,934,927	[10] 141,349
Vanadium (recoverable in ore and concentrate) thousand pounds	7,735	(14)	7,383	(14)	6,061	10,817	7,438	13,278
Zinc (recoverable content of ores, etc.)	542,340	148,503	531,735	123,235	412,005	84,113	425,303	97,787
Value of items that cannot be disclosed: Magnesium chloride for magnesium metal, platinum-group metals (crude), zirconium concentrate, and values indicated by footnote 14	------	48,704	------	59,558	------	22,264	------	21,763
Total metals	------	2,358,000	------	2,137,000	------	[6] 1,593,000	------	1,570,000
Grand total mineral production	------	17,365,000	------	18,113,000	------	[6] 16,528,000	------	17,084,000

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[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Includes small quantity of anthracite mined in States other than Pennsylvania.

[3] Preliminary figure.

[4] Grindstones, pulpstones, millstones, grinding pebbles, and tubemill liners, weight not recorded; excludes value of sharpening stones (1956–58), value for which is included with "Nonmetal items that cannot be disclosed".

[5] Excludes tubemill liners, value for which is included with "Nonmetal items that cannot be disclosed".

[6] Revised figure.

[7] Weight not recorded.

[8] Beginning with 1947 calcareous marl included with stone.

[9] Figure withheld to avoid disclosing individual company confidential data; value included with "Nonmetal items that cannot be disclosed".

[10] Final figure. Supersedes preliminary figure given in commodity chapter.

[11] Beginning with 1958 slate included with stone.

[12] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table.

[13] Total adjusted to eliminate duplicating value of clays and stone.

[14] Figure withheld to avoid disclosing individual company confidential data; value included with "Metal items that cannot be disclosed".

[15] Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low grade ore and concentrate stockpiled near Coquille, Oreg., during World War II.

[16] Excludes quantity consumed by American Chrome Co.

[17] Total weight of columbite-tantalite plus $(Cb\text{–}Ta)_2O_5$ content of euxenite.

TABLE 3.—Minerals produced in the United States and principal producing States in 1959

Mineral	Principal producing States, in order of quantity	Other producing States
Antimony	Idaho, Nev	
Aplite	Va	
Asbestos	Vt., Ariz., Calif., N.C	
Asphalt	Tex., Utah, Ala., Okla	Mo.
Barite	Ark., Mo., Nev., Ga	Calif., Idaho, Ky., Mont., N. Mex., S.C. Tenn., Utah, Wash.
Bauxite	Ark., Ala., Ga	
Beryllium	S. Dak., Colo., N.H., Conn	Maine, N. Mex., Wyo.
Boron	Calif	
Bromine	Mich., Tex., Ark.. Calif	W. Va.
Brucite	Nev	
Calcium magnesium chloride.	Mich., Calif., W. Va	
Carbon dioxide	N. Mex., Colo., Utah, Wash	Oreg.
Cement	Calif., Pa., Tex., Mich	All others except Alaska, Conn., Del., Hawaii, Mass., Nev., N.H., N.J., N.C., N. Dak., R.I., Vt.
Chromite	Mont., Calif	
Clays	Ohio, Tex., Pa., Ga	All others except R.I.
Coal	W. Va., Pa., Ky., Ill	Ala., Alaska, Ariz., Ark., Colo., Ga., Ind., Iowa, Kans., Md., Mo., Mont., N. Mex., N. Dak., Ohio, Okla., S. Dak., Tenn. Utah, Va., Wash., Wyo.
Cobalt	Mo., Idaho, Pa	
Columbium-tantalum	Idaho	
Copper	Ariz., Utah, Mont., Nev	Alaska, Calif., Colo., Idaho, Mich., Mo., N. Mex., N.C., Pa., Tenn., Wash.
Diatomite	Calif., Nev., Oreg., Wash	
Emery	N.Y	
Feldspar	N.C., Calif., N.H., Ga	Ariz., Colo., Conn., Maine, S.C., S. Dak., Tex., Va.
Fluorspar	Ill., Ky., Mont., Colo	Nev., N. Mex., Utah.
Garnet	N.Y., Idaho	
Gold	S. Dak., Utah, Alaska, Calif	Ariz., Colo., Idaho, Mont., Nev., N. Mex., N.C., Oreg., Pa., Tenn., Wash.
Graphite	Tex., R.I., Pa	
Gypsum	Mich., Calif., Tex., Iowa	Ariz., Ark., Colo., Idaho, Ind., Kans., La., Mont., Nev., N.Y., Ohio, Okla., S. Dak., Utah, Va., Wash., Wyo.
Helium	Tex., Okla., Kans., N. Mex	
Iodine	Calif	
Iron ore	Minn., Mich., Ala., Utah	Calif., Colo., Ga., Idaho, Mo., Mont., Nev., N.J., N. Mex., N.Y., N.C., Oreg., Pa., Tenn., Tex., Va., Wash., Wis., Wyo.
Kyanite	Va., S.C	
Lead	Mo., Idaho, Utah, Colo	Ariz., Ark., Calif., Ill., Kans., Ky., Mont., Nev., N. Mex., N.Y., Okla., Va., Wash., Wis.
Lime	Ohio, Mo., Pa., N.Y	Ala., Ariz., Ark., Calif., Colo., Conn., Fla., Hawaii, Ill., Iowa, La., Md., Mass., Mich., Minn., Mont., Nev., N.J., N. Mex., Okla., Oreg., S. Dak., Tenn., Tex., Utah, Vt., Va., W. Va., Wis.
Magnesite	Wash., Nev., Calif	
Magnesium chloride	Tex	
Magnesium compounds	Mich., Calif., N.J., Tex	Ala., Fla., Miss., N. Mex.
Manganese	Ariz., Nev., N. Mex., Mont	Ark., Calif., Colo., Ga., Tenn., Utah, Va. Wash.
Mercury	Calif., Nev., Alaska, Idaho	Ariz., Oreg., Tex.
Mica:		
Sheet	N.C., N.H., S. Dak., Maine	Ala., Ga., Idaho, Mass., Mont., N. Mex., S.C., Va., Wyo.
Scrap	N.C., Ga., Ala., S.C	Ariz., Colo., Maine, N.H., N. Mex., Pa., S. Dak., Tenn.
Molybdenum	Colo., Utah, Ariz., Calif	Nev., N. Mex.
Natural gas	Tex., La., N. Mex., Okla	Ala., Alaska, Ark., Calif., Colo., Fla., Ill., Ind., Kans., Ky., Md., Mich., Miss., Mont., Neb., N.Y., N. Dak., Ohio, Pa., Tenn., Utah, Va., W. Va., Wyo.
Natural-gas liquids	Tex., La., Calif., Okla	Ark., Colo., Ill., Kans., Ky., Mich., Miss., Mont., Nebr., N. Mex., N. Dak., Pa., Utah., W. Va., Wyo.
Nickel	Oreg., Mo., Idaho	
Olivine	N.C., Wash	
Peat	Mich, Calif., Fla., Wash	Colo., Conn., Ga., Idaho, Ill., Ind., Maine, Mass., N.H., N.J., N.Y., Ohio, Pa., S.C., Wis.
Perlite	N. Mex., Nev., Ariz., Calif	Colo., Utah.

TABLE 3.—Minerals produced in the United States and principal producing States in 1959—Continued

Mineral	Principal producing States, in order of quantity	Other producing States
Petroleum	Tex., La., Calif., Okla.	Ala., Alaska, Ariz., Ark., Colo., Fla., Ill., Ind., Kans., Ky., Mich., Miss., Mont., Nebr., Nev., N. Mex., N.Y., N. Dak., Ohio, Pa., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wyo.
Phosphate rock	Fla., Tenn., Idaho, Mont.	Utah, Wyo.
Platinum-group metals	Alaska, Calif.	
Potassium salts	N. Mex., Calif., Utah, Mich.	Md.
Pumice	Calif., N. Mex., Ariz., Hawaii	Colo., Idaho, Kans., Nebr., Nev., Okla., Oreg., Utah, Wash., Wyo.
Pyrites	Tenn., Va., Calif., Colo.	Ariz., Mont., Pa., Utah.
Rare-earth metals	Idaho, Fla., Calif., Mont.	Colo.
Salt	La., Tex., Mich., N.Y.	Ala., Calif., Colo., Kans., Nev., N. Mex., Ohio, Okla., Utah, Va., W. Va.
Sand and gravel	Calif., Mich., Wis., Ohio	All other States.
Silver	Idaho, Ariz., Utah, Mont.	Alaska, Calif., Colo., Ky., Mo., Nev., N. Mex., N.Y., N.C., Oreg., Pa. S. Dak., Tenn., Va., Wash.
Sodium carbonate	Wyo., Calif.	
Sodium sulfate	Calif., Tex., Wyo.	
Stone	Pa., Tex., Ohio, Ill.	All other States.
Strontium	Calif., Wash.	
Sulfur (Frasch)	Tex., La.	
Sulfur ore	Calif., Nev.	
Talc, pyrophyllite, and soapstone.	N.Y., Calif., N.C., Vt.	Ala., Ark., Ga., Md., Mont., Nev., Pa., Tex., Va., Wash.
Tin	Colo.	
Titanium	N.Y., Fla., Va., Idaho	
Tripoli	Ill., Okla., Pa.	
Tungsten	Calif., Colo., N.C., Nev.	Ariz.
Uranium	N. Mex., Utah, Colo., Wyo.	Alaska, Ariz., Calif., Idaho, Mont., Nev., Oreg., S. Dak., Tex., Wash.
Vanadium	Colo., Utah, Ariz.	N. Mex.
Vermiculite	Mont., S.C.	
Wollastonite	N.Y., Calif.	
Zinc	Tenn., Idaho, N.Y., Ariz.	Ark., Calif., Colo., Ill., Kans., Ky., Mo., Mont., Nev., N. Mex., Okla., Pa., Utah, Va., Wash., Wis.
Zirconium	Fla.	

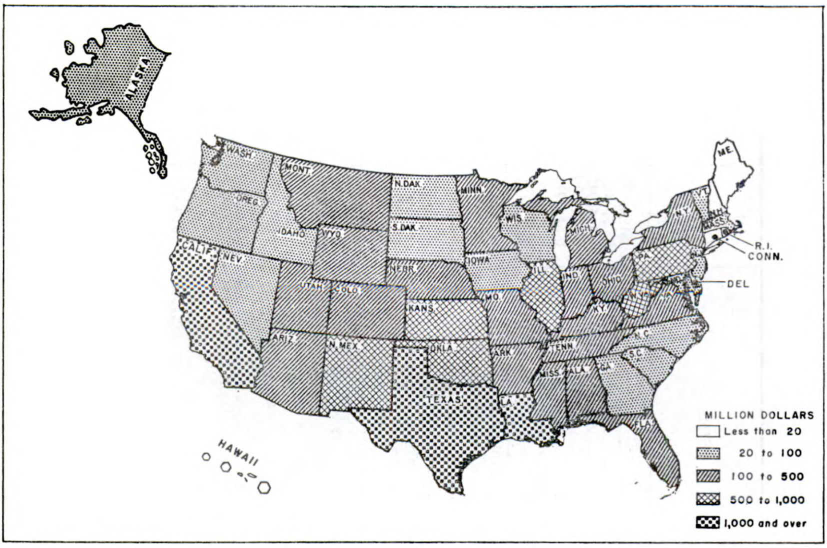

FIGURE 2.—Value of mineral production in the United States, 1959, by States.

TABLE 4.—Value of mineral production in the United States, in thousand dollars, and principal minerals produced in 1959

State	1956	1957	1958	1959			
				Value	Rank	Percent of U.S. total	Principal minerals in order of value
Alabama	$189,186	$209,549	$188,938	$199,319	21	1.17	Coal, cement, stone, iron ore.
Alaska	23,408	28,792	21,450	20,495	44	.12	Gold, coal, sand and gravel, mercury.
Arizona	484,959	372,641	314,520	326,888	16	1.91	Copper, sand and gravel, zinc, cement.
Arkansas	134,049	142,685	131,603	140,555	27	.82	Petroleum, bauxite, sand and gravel, stone.
California	1,543,978	1,650,035	1,500,367	1,424,039	3	8.34	Petroleum, cement, natural gas, sand and gravel.
Colorado	321,908	338,504	306,561	313,438	17	1.83	Petroleum, molybdenum, uranium ore, coal.
Connecticut	11,737	16,055	13,128	12,930	46	.08	Stone, sand and gravel, lime, clays.
Delaware	1,232	1,042	1,142	1,284	50	.01	Sand and gravel, stone, clays.
District of Columbia	-----------	72	72	75	51	(1)	
Florida	140,490	140,467	142,114	163,447	24	.96	Phosphate rock, stone, cement, titanium.
Georgia	67,912	69,799	75,106	86,262	30	.50	Clays, stone, cement, sand and gravel.
Hawaii	6,972	5,930	6,298	7,630	47	.05	Stone, sand and gravel, pumice, lime.
Idaho	75,150	73,502	64,648	70,209	32	.41	Silver, lead, zinc, sand and gravel.
Illinois	572,247	576,324	576,862	577,372	8	3.38	Petroleum, coal, stone, sand and gravel.
Indiana	196,439	198,034	197,677	207,701	20	1.22	Coal, stone, petroleum, sand and gravel.
Iowa	66,529	68,986	85,356	88,557	29	.52	Cement, stone, sand and gravel, gypsum.
Kansas	493,770	511,513	503,788	500,464	9	2.93	Petroleum, natural gas, cement, stone.
Kentucky	443,168	449,390	402,121	416,391	10	2.44	Coal, petroleum, stone, natural gas.
Louisiana	1,288,116	1,517,522	1,523,370	1,654,493	2	9.68	Petroleum, natural gas, natural-gas liquids, sulfur.
Maine	12,728	12,711	12,574	13,278	45	.08	Cement, sand and gravel, stone, mica.
Maryland	40,534	39,625	45,735	53,508	37	.31	Cement, stone, sand and gravel, coal.
Massachusetts	25,085	24,789	23,887	25,916	42	.15	Stone, sand and gravel, lime, clays.
Michigan	394,556	404,673	343,487	379,244	13	2.22	Cement, iron ore, sand and gravel, salt.
Minnesota	501,027	584,038	395,880	347,178	15	2.03	Iron ore, sand and gravel, stone, cement.
Mississippi	133,098	144,950	151,411	181,086	22	1.06	Petroleum, natural gas, sand and gravel, cement.
Missouri	163,693	152,913	144,120	157,009	25	.92	Cement, stone, lead, lime.
Montana	213,704	191,750	176,728	167,890	23	.98	Petroleum, copper, sand and gravel, zinc.
Nebraska	71,311	82,928	90,047	100,213	28	.59	Petroleum, cement, sand and gravel, stone.
Nevada	126,681	86,023	68,293	70,159	33	.41	Copper, sand and gravel, gold, manganese ore.
New Hampshire	3,436	3,331	3,919	4,722	48	.03	Sand and gravel, mica, stone, feldspar.
New Jersey	63,988	64,642	50,380	59,479	36	.35	Stone, sand and gravel, iron ore, magnesium compounds.
New Mexico	514,903	551,155	559,777	600,269	7	3.51	Petroleum, natural gas, potassium salts, uranium ore.
New York	237,016	244,114	205,338	235,119	18	1.38	Cement, stone, sand and gravel, salt.
North Carolina	40,873	37,570	39,891	40,789	40	.24	Stone, sand and gravel, mica, feldspar.
North Dakota	53,509	56,702	59,445	67,649	34	.40	Petroleum, sand and gravel, coal, natural-gas liquids.
Ohio	375,488	383,000	344,856	395,901	11	2.32	Coal, cement, stone, sand and gravel.
Oklahoma	757,080	809,004	761,936	751,907	5	4.40	Petroleum, natural gas, natural-gas liquids, cement.
Oregon	34,021	42,820	45,190	49,831	38	.29	Stone, sand and gravel, cement, nickel.
Pennsylvania	1,088,481	1,077,157	882,040	863,818	4	5.06	Coal, cement, stone, natural gas.

Rhode Island	1, 627	1, 369	2, 249	2, 333	49	.01	Sand and gravel, stone, graphite.
South Carolina	21, 342	22, 168	22, 412	30, 598	41	.18	Cement, stone, clays, sand and gravel.
South Dakota	42, 281	39, 997	41, 534	48, 485	39	.28	Gold, sand and gravel, stone, cement.
Tennessee	137, 846	128, 739	124, 934	140, 739	26	.82	Stone, cement, coal, phosphate rock.
Texas	4, 241, 258	4, 484, 538	4, 033, 311	4, 201, 203	1	24. 59	Petroleum, natural gas, natural-gas liquids, cement.
Utah	399, 759	359, 335	367, 232	373, 017	14	2. 18	Petroleum, copper, uranium ore, coal.
Vermont	23, 131	21, 893	21, 443	23, 359	43	.14	Stone, asbestos, sand and gravel, talc.
Virginia	208, 806	227, 108	203, 277	222, 304	19	1. 30	Coal, stone, cement, sand and gravel.
Washington	61, 723	60, 471	60, 896	63, 894	35	.37	Sand and gravel, cement, stone, gold.
West Virginia	934, 999	981, 654	749, 747	737, 886	6	4. 32	Coal, natural gas, natural-gas liquids, sand and gravel.
Wisconsin	65, 860	68, 644	71, 334	71, 959	31	.42	Sand and gravel, stone, cement, iron ore.
Wyoming	314, 380	352, 532	369, 938	391, 621	12	2. 29	Petroleum, uranium, sodium carbonate, natural gas.
Total	17, 365, 000	18, 113, 000	16, 528, 000	17, 084, 000		100. 00	Petroleum, coal, natural gas, cement.

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[1] Less than 1 percent.

TABLE 5.—Mineral production[1] in the United States, by States

ALABAMA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement [3] ..... thousand 376-pound barrels	14,065	$41,840	13,000	$40,279	13,588	$42,930	14,819	$46,639
Clays [4] ..... thousand short tons	1,594	2,147	1,316	1,504	1,548	1,787	1,786	2,089
Coal ..... do	12,663	79,322	13,260	86,114	11,182	72,360	11,947	78,212
Iron ore (usable) ..... thousand long tons, gross weight	5,633	34,824	6,223	40,518	3,659	23,393	4,165	23,922
Lime ..... thousand short tons	466	5,089	554	6,271	520	[5] 5,851	579	6,847
Mica (sheet) ..... pounds	1,122	7	(6)	(6)	(6)	(6)	818	7
Natural gas ..... million cubic feet	42	3	190	12	323	30	[7] 320	[7] 30
Petroleum (crude) ..... thousand 42-gallon barrels	3,069	7,335	5,406	(6)	5,887	(6)	[7] 5,019	(6)
Sand and gravel ..... thousand short tons	4,999	4,621	5,065	4,883	4,128	4,210	4,352	4,594
Stone [8] ..... do	12,343	14,702	9,519	11,972	11,080	17,068	11,886	18,728
Talc	2,200	5	1,600	3	(6)	(6)	(6)	(6)
Value of items that cannot be disclosed: Native asphalt, bauxite, slag cement, clays (kaolin), scrap mica, salt, stone (dimension limestone and marble 1957-59, shell, 1957, 1959, crushed sandstone 1959), and values indicated by footnote 6	----------	4,083	----------	23,344	----------	26,508	----------	23,860
Total Alabama [9]	----------	189,186	----------	209,549	----------	[5] 188,938	----------	199,319
ALASKA								
Antimony ore and concentrate ..... antimony content	28	(6)	17	(6)	----------	----------	----------	----------
Chromite ..... gross weight	7,193	$711	4,207	$431	----------	----------	----------	----------
Clays ..... thousand short tons	----------	----------	----------	----------	----------	----------	(10)	$1
Coal ..... do	727	6,374	842	7,296	759	$6,931	660	5,869
Copper (recoverable content of ores, etc.)	(11)	(12)	(11)	(12)	5	3	36	22
Gem stones	(13)	(6)	(13)	(6)	(13)	(6)	(13)	18
Gold (recoverable content of ores, etc.) ..... troy ounces	209,296	7,325	215,467	7,541	186,435	6,525	178,918	6,262
Lead (recoverable content of ores, etc.)	1	(12)	9	3	2	(12)	----------	----------
Mercury ..... 76-pound flasks	3,280	853	5,461	1,349	3,380	774	3,743	852
Natural gas ..... million cubic feet	----------	----------	----------	----------	50	6	[7] 133	[7] 16
Petroleum (crude) ..... thousand 42-gallon barrels	----------	----------	----------	----------	(6)	(6)	[7] 187	[7] 295
Sand and gravel ..... thousand short tons	5,955	5,880	6,096	8,799	4,255	3,871	5,859	5,265
Silver (recoverable content of ores, etc.) ..... thousand troy ounces	28	26	29	26	24	22	21	19
Stone ..... thousand short tons	195	595	528	1,953	615	2,065	89	377
Value of items that cannot be disclosed: Platinum-group metals, uranium ore (1957-59), and values indicated by footnote 6	----------	1,644	----------	1,394	----------	1,253	----------	1,499
Total Alaska	----------	23,408	----------	28,792	----------	21,450	----------	20,495

ARIZONA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate ... gross weight	6	$3	5	$2	18	$10	----	----
Clays [4] ... thousand short tons	112	168	118	177	119	179	120	$179
Columbium-tantalum concentrate ... pounds	----	----	2,435	7	----	----	----	----
Coal ... thousand short tons	10	66	9	62	8	54	7	63
Copper (recoverable content of ores, etc.)	505,908	430,022	515,854	310,544	485,839	255,551	430,297	264,202
Gem stones	(13)	104	(13)	75	(13)	86	(13)	88
Gold (recoverable content of ores, etc.) ... troy ounces	146,110	5,114	152,449	5,336	142,979	5,004	124,627	4,362
Gypsum ... thousand short tons	96	366	(6)	(6)	(6)	(6)	(6)	(6)
Lead (recoverable content of ores, etc.)	11,999	3,768	12,441	3,558	11,890	2,782	9,999	2,300
Lime ... thousand short tons	127	1,756	138	2,127	126	1,817	123	1,666
Manganese ore (35 percent or more Mn) ... gross weight	42,088	3,468	79,505	6,626	62,279	5,220	68,183	5,727
Manganiferous ore (5 to 35 percent Mn) ... do	----	----	----	----	1,455	32	10,693	234
Mercury ... 76-pound flasks	(6)	(6)	28	7	53	12	(6)	(6)
Mica (scrap)	----	----	1,650	17	1,717	25	3,069	55
Molybdenum (content of concentrate) ... thousand pounds	2,392	2,670	2,385	3,071	2,320	2,827	3,181	4,019
Natural gas ... million cubic feet	21	3	22	3	----	----	----	----
Perlite	15,928	108	15,646	114	(6)	(6)	(6)	(6)
Petroleum (crude) ... thousand 42-gallon barrels	----	----	----	----	12	(6)	[7] 34	(6)
Pumice ... thousand short tons	115	366	397	640	401	1,025	487	1,153
Sand and gravel ... do	7,932	6,167	10,287	9,222	12,208	9,526	13,458	11,966
Silver (recoverable content of ores, etc.) ... thousand troy ounces	5,179	4,687	5,279	4,778	4,685	4,240	3,898	3,528
Stone ... thousand short tons	1,623	2,474	2,101	2,982	1,528	2,731	2,468	3,998
Tungsten concentrate ... 60-percent WO$_3$ basis	186	637	5	9	----	----	(11)	(6)
Uranium ore	274,505	5,408	286,037	6,277	257,756	7,049	253,390	6,309
Zinc (recoverable content of ores, etc.)	25,580	7,009	33,905	7,866	28,532	5,821	37,325	8,585
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite 1956, 1958–59), feldspar, fluorspar (1956–58), nitrogen compounds (1957–58), pyrites (1957–59), vanadium, and values indicated by footnote 6	----	11,701	----	10,441	----	11,734	----	9,837
Total Arizona [9]	----	484,959	----	372,641	----	314,520	----	326,888

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

ARKANSAS

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones (whetstones)	35	$11	---	---	---	---	---	---
Barite	486,254	4,256	477,327	$4,537	182,779	$1,668	338,539	$3,097
Bauxite ... long tons, dried equivalent	1,668,432	13,307	1,356,898	12,314	1,257,916	11,394	1,631,643	17,048
Clays ... thousand short tons	719	1,636	617	1,586	578	1,578	782	2,406
Coal ... do	590	4,601	508	3,976	364	2,744	441	3,482
Gem stones	(13)	25	(13)	(6)	(13)	23	(13)	18
Iron ore (usable) ... thousand long tons, gross weight	(6)	(6)	7	35	(6)	(6)	---	---
Lead (recoverable content of ores, etc.)	---	---	---	---	---	---	38	9
Manganese ore (35 percent or more Mn) ... gross weight	29,485	2,066	23,261	1,726	22,221	1,737	17,742	1,398
Natural gas ... million cubic feet	30,162	1,810	31,327	2,256	32,890	2,664	[7] 42,500	[7] 3,500
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	41,529	2,541	39,869	2,313	37,197	2,574	40,730	2,523
LP-gases ... do	56,146	2,293	54,034	2,097	53,518	2,743	55,731	3,048
Petroleum (crude) ... thousand 42-gallon barrels	29,355	78,965	31,047	90,657	28,700	80,934	[7] 26,329	[7] 72,931
Sand and gravel ... thousand short tons	10,200	8,730	8,599	6,949	8,644	7,039	11,696	11,857
Stone ... do	6,325	8,113	7,278	8,378	8,461	10,178	8,824	10,424
Zinc (recoverable content of ores, etc.)	---	---	---	---	---	---	49	11
Value of items that cannot be disclosed: Abrasive stones, bromine (1957–59), cement, gypsum, lime, slate (1956–57), soapstone, and values indicated by footnote 6	---	8,182	---	6,933	---	7,241	---	10,042
Total Arkansas[9]	---	134,049	---	142,685	---	131,603	---	140,555

CALIFORNIA

Barite	(6)	(6)	(6)	(6)	24,812	$272	28,143	$326
Boron minerals	546,815	$32,848	541,124	$38,041	528,209	38,310	619,946	46,150
Cement thousand 376-pound barrels	39,290	120,511	[2] 37,731	[2] 117,852	[2] 39,583	[2] 124,367	[2] 43,635	[2] 138,506
Chromite gross weight	27,082	2,192	34,901	2,789	20,588	1,646	(6)	(12)
Clays thousand short tons	2,982	6,137	[4] 2,729	[4] 5,740	2,394	5,012	2,726	5,646
Coal (lignite) do	12	120	(6)	(6)	(6)	(6)	(6)	(6)
Copper (recoverable content of ores, etc.)	859	730	945	569	749	394	663	407
Feldspar long tons	107,958	1,080	67,869	581	71,193	624	76,489	666
Gem stones	(13)	90	(13)	100	(13)	150	(13)	150
Gold (recoverable content of ores, etc.) troy ounces	193,816	6,784	170,885	5,981	185,385	6,489	146,141	5,115
Gypsum thousand short tons	1,399	3,402	1,268	2,995	1,423	3,184	1,686	3,788
Iron ore (usable) thousand long tons, gross weight	2,414	(6)	(6)	(6)	(6)	(6)	(6)	(6)
Lead (recoverable content of ores, etc.)	9,296	2,919	3,458	989	140	33	227	52
Lime thousand short tons	302	5,078	325	5,408	262	4,470	358	5,817
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	66,007	4,532	74,295	5,077	74,132	4,854	87,968	6,336
Manganese ore (35 percent or more Mn) gross weight	6,595	595	9,009	802	17,644	1,516	19,354	1,663
Mercury 76-pound flasks	9,017	2,344	16,511	4,078	22,365	5,123	17,100	3,890
Natural gas million cubic feet	504,458	113,503	492,338	116,684	465,582	108,481	[7] 488,664	[7] 114,152
Natural-gas liquids:								
Natural gasoline and cycle products thousand gallons	876,902	84,615	843,378	81,355	853,045	68,485	834,258	68,023
LP-gases do	410,232	21,332	390,743	20,421	342,992	18,678	396,331	21,260
Peat	18,918	215	35,916	424	28,617	374	34,604	449
Perlite	15,119	135	15,109	113	14,883	114	(6)	(6)
Petroleum (crude) thousand 42-gallon barrels	350,754	918,975	339,646	1,035,920	313,672	909,649	[7] 307,327	[7] 783,684
Pumice thousand short tons	634	2,334	459	1,510	377	1,670	574	2,162
Salt (common) do	1,444	7,606	1,330	8,721	1,297	(6)	1,388	(6)
Sand and gravel do	86,447	96,526	78,983	87,030	84,137	95,340	87,945	108,909
Silver (recoverable content of ores, etc.) thousand troy ounces	938	849	522	473	188	170	173	156
Stone thousand short tons	32,583	46,109	41,351	53,591	32,423	48,345	32,134	49,090
Talc, pyrophyllite and soapstone	153,710	1,419	133,915	1,526	[5] 129,638	[5] 1,339	148,266	1,500
Tungsten concentrate 60-percent WO$_3$ basis	3,719	13,449	1,750	2,735	(6)	(6)	(6)	(6)
Wollastonite	-----	-----	-----	-----	1,652	17	(6)	(6)
Zinc (recoverable content of ores, etc.)	8,049	2,205	2,969	689	51	10	78	18
Value of items that cannot be disclosed: Asbestos, bromine, calcium-magnesium chloride, carbon dioxide (1956–57, 1959), masonry cement, clay (kaolin 1957), diatomite, fluorspar (1957–58), abrasive garnet (1956), iodine, lithium minerals (1958–59), magnesite (1956, 1958–59), mica (1956–58), molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate (1956–57), sodium carbonate and sulfate, strontium minerals (1956–57, 1959), sulfur ore, uranium ore, and values indicated by footnote 6	-----	63,654	-----	65,352	-----	[5] 68,564	-----	73,374
Total California [9]	-----	1,543,978	-----	1,650,035	-----	[5] 1,500,367	-----	1,424,039

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States

ALABAMA

Mineral	1956 Short tons (unless otherwise stated)	1956 Value (thousands)	1957 Short tons (unless otherwise stated)	1957 Value (thousands)	1958 Short tons (unless otherwise stated)	1958 Value (thousands)	1959 Short tons (unless otherwise stated)	1959 Value (thousands)
Cement[3] thousand 376-pound barrels	14,065	$41,840	13,000	$40,279	13,588	$42,930	14,819	$46,639
Clays[4] thousand short tons	1,594	2,147	1,316	1,504	1,548	1,787	1,786	2,089
Coal do	12,663	79,322	13,260	86,114	11,182	72,360	11,947	78,212
Iron ore (usable) thousand long tons, gross weight	5,633	34,824	6,223	40,518	3,659	23,393	4,165	23,922
Lime thousand short tons	466	5,089	554	6,271	520	[5] 5,851	579	6,847
Mica (sheet) pounds	1,122	7	(6)	(6)	(6)	(6)	818	7
Natural gas million cubic feet	42	3	190	12	323	30	[7] 320	[7] 30
Petroleum (crude) thousand 42-gallon barrels	3,069	7,335	5,406	(6)	5,887	(6)	[7] 5,019	(6)
Sand and gravel thousand short tons	4,999	4,621	5,065	4,883	4,128	4,210	4,352	4,594
Stone[8] do	12,343	14,702	9,519	11,972	11,080	17,068	11,886	18,728
Talc	2,200	5	1,600	3	(6)	(6)	(6)	(6)
Value of items that cannot be disclosed: Native asphalt, bauxite, slag cement, clays (kaolin), scrap mica, salt, stone (dimension limestone and marble 1957–59, shell, 1957, 1959, crushed sandstone 1959), and values indicated by footnote 6		4,083		23,344		26,508		23,860
Total Alabama[9]		189,186		209,549		[5] 188,938		199,319

ALASKA

Mineral	1956 Short tons (unless otherwise stated)	1956 Value (thousands)	1957 Short tons (unless otherwise stated)	1957 Value (thousands)	1958 Short tons (unless otherwise stated)	1958 Value (thousands)	1959 Short tons (unless otherwise stated)	1959 Value (thousands)
Antimony ore and concentrate antimony content	28	(6)	17	(6)				
Chromite gross weight	7,193	$711	4,207	$431				
Clays thousand short tons							(10)	$1
Coal do	727	6,374	842	7,296	759	$6,931	660	5,869
Copper (recoverable content of ores, etc.)	(11)	(12)	(11)	(12)	5	3	36	22
Gem stones	(13)	(6)	(13)	(6)	(13)	(6)	(13)	18
Gold (recoverable content of ores, etc.) troy ounces	209,296	7,325	215,467	7,541	186,435	6,525	178,918	6,262
Lead (recoverable content of ores, etc.)	1	(12)	9	3	2	(12)		
Mercury 76-pound flasks	3,280	853	5,461	1,349	3,380	774	3,743	852
Natural gas million cubic feet					50	6	[7] 133	[7] 16
Petroleum (crude) thousand 42-gallon barrels					(6)	(6)	[7] 187	[7] 295
Sand and gravel thousand short tons	5,955	5,880	6,096	8,799	4,255	3,871	5,859	5,265
Silver (recoverable content of ores, etc.) thousand troy ounces	28	26	29	26	24	22	21	19
Stone thousand short tons	195	595	528	1,953	615	2,065	89	377
Value of items that cannot be disclosed: Platinum-group metals, uranium ore (1957–59), and values indicated by footnote 6		1,644		1,394		1,253		1,499
Total Alaska		23,408		28,792		21,450		20,495

CONNECTICUT

Beryllium concentrate .... gross weight..	(6)	(6)	(6)	(6)	(6)	(6)	13	$8
Clays .... thousand short tons..	338	$390	308	$409	199	$299	280	368
Gem stones	----------	----------	(13)	(6)	(13)	3	(13)	5
Lime .... thousand short tons..	40	609	30	503	29	464	(6)	(6)
Mica, sheet .... pounds..	310	2	(6)	(6)	(6)	(12)	----------	----------
Peat	3,190	13	2,004	11	1,764	11	2,090	13
Sand and gravel .... thousand short tons..	4,369	4,101	4,777	5,042	5,019	5,479	4,749	4,912
Stone .... do....	4,428	[8] 6,590	6,199	10,040	4,223	6,863	4,462	7,088
Value of items that cannot be disclosed: Feldspar, stone (dimension limestone 1956), and values indicated by footnote 6. Excludes limestone used in manufacturing lime (1959)	----------	124	----------	119	----------	89	----------	536
Total Connecticut	----------	[9] 11,737	----------	16,055	----------	[9] 13,128	----------	12,930

DELAWARE

Sand and gravel .... thousand short tons..	1,160	$967	974	$860	1,090	$962	1,241	$1,071
Stone .... do....	83	232	(6)	(6)	(6)	(6)	(6)	(6)
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 6	----------	33	----------	182	----------	180	----------	213
Total Delaware	----------	1,232	----------	1,042	----------	1,142	----------	1,284

FLORIDA

Clays .... thousand short tons..	432	$5,826	422	$6,067	450	$5,808	[4] 245	[4] $6,171
Gem stones	(13)	(6)	----------	----------	----------	----------	(13)	3
Lime .... thousand short tons..	40	490	(6)	(6)	(6)	(6)	111	1,238
Natural gas .... million cubic feet..	35	3	34	4	35	5	[7] 34	[7] 6
Peat	58,496	203	37,844	195	36,438	165	34,446	158
Petroleum (crude) .... thousand 42-gallon barrels..	479	(6)	461	(6)	449	(6)	[7] 424	(6)
Phosphate rock .... thousand long tons..	11,822	74,290	10,191	64,789	10,851	68,951	11,564	71,208
Sand and gravel .... thousand short tons..	5,815	5,034	6,753	6,148	5,490	4,389	6,674	5,177
Stone .... do....	18,779	25,183	21,786	30,467	[8] 23,549	[8] 30,983	[8] 26,917	[8] 35,940
Titanium concentrates .... thousand short tons, gross weight..	(6)	(6)	263	10,643	190	5,495	262	7,196
Zirconium concentrate	43,794	2,160	56,802	1,976	30,302	1,018	(6)	(6)
Value of items that cannot be disclosed: Cement, clays (kaolin and miscellaneous clay 1959), abrasive garnet (1956), magnesium compounds (1959), rare-earth metals concentrates, staurolite (1957–59), stone (dimension limestone 1958–59), and values indicated by footnote 6	----------	28,452	----------	[5] 22,514	----------	[5] 28,510	----------	40,034
Total Florida [9]	----------	140,490	----------	140,467	----------	[5] 142,114	----------	163,447

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

ARKANSAS

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones (whetstones)	35	$11	----------	----------	----------	----------	----------	----------
Barite	486,254	4,256	477,327	$4,537	182,779	$1,668	338,539	$3,097
Bauxite ... long tons, dried equivalent	1,668,432	13,307	1,356,898	12,314	1,257,916	11,394	1,631,643	17,048
Clays ... thousand short tons	719	1,636	617	1,586	578	1,578	782	2,406
Coal ... do	590	4,601	508	3,976	364	2,744	441	3,482
Gem stones	(13)	25	(13)	(6)	(13)	23	(13)	18
Iron ore (usable) ... thousand long tons, gross weight	(6)	(6)	7	35	(6)	(6)	----------	----------
Lead (recoverable content of ores, etc.)	----------	----------	----------	----------	----------	----------	38	9
Manganese ore (35 percent or more Mn) ... gross weight	29,485	2,066	23,261	1,726	22,221	1,737	17,742	1,398
Natural gas ... million cubic feet	30,162	1,810	31,327	2,256	32,890	2,664	[7] 42,500	[7] 3,500
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	41,529	2,541	39,869	2,313	37,197	2,574	40,730	2,523
LP-gases ... do	56,146	2,293	54,034	2,097	53,518	2,743	55,731	3,048
Petroleum (crude) ... thousand 42-gallon barrels	29,355	78,965	31,047	90,657	28,700	80,934	[7] 26,329	[7] 72,931
Sand and gravel ... thousand short tons	10,200	8,730	8,599	6,949	8,644	7,039	11,696	11,857
Stone ... do	6,325	8,113	7,278	8,378	8,461	10,178	8,824	10,424
Zinc (recoverable content of ores, etc.)	----------	----------	----------	----------	----------	----------	49	11
Value of items that cannot be disclosed: Abrasive stones, bromine (1957-59), cement, gypsum, lime, slate (1956-57), soapstone, and values indicated by footnote 6	----------	8,182	----------	6,933	----------	7,241	----------	10,042
Total Arkansas[9]	----------	134,049	----------	142,685	----------	131,603	----------	140,555

CALIFORNIA

Barite	(6)	(6)	(6)	(6)	24,812	$272	28,143	$326
Boron minerals	546,815	$32,848	541,124	$38,041	528,209	38,310	619,946	46,150
Cement, thousand 376-pound barrels	39,290	120,511	[2] 37,731	[2] 117,852	[2] 39,583	[2] 124,367	[2] 43,635	[2] 138,506
Chromite, gross weight	27,082	2,192	34,901	2,789	20,588	1,646	(6)	(12)
Clays, thousand short tons	2,982	6,137	[4] 2,729	[4] 5,740	2,394	5,012	2,726	5,646
Coal (lignite), do	12	120	(6)	(6)	(6)	(6)	(6)	(6)
Copper (recoverable content of ores, etc.)	859	730	945	569	749	394	663	407
Feldspar, long tons	107,958	1,080	67,869	581	71,193	624	76,489	666
Gem stones	(13)	90	(13)	100	(13)	150	(13)	150
Gold (recoverable content of ores, etc.), troy ounces	193,816	6,784	170,885	5,981	185,385	6,489	146,141	5,115
Gypsum, thousand short tons	1,399	3,402	1,268	2,995	1,423	3,184	1,686	3,788
Iron ore (usable), thousand long tons, gross weight	2,414	(6)	(6)	(6)	(6)	(6)	(6)	(6)
Lead (recoverable content of ores, etc.)	9,296	2,919	3,458	989	140	33	227	52
Lime, thousand short tons	302	5,078	325	5,408	262	4,470	358	5,817
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	66,007	4,532	74,295	5,077	74,132	4,854	87,968	6,336
Manganese ore (35 percent or more Mn), gross weight	6,595	595	9,009	802	17,644	1,516	19,354	1,663
Mercury, 76-pound flasks	9,017	2,344	16,511	4,078	22,365	5,123	17,100	3,890
Natural gas, million cubic feet	504,458	113,503	492,338	116,684	465,582	108,481	[7] 488,664	[7] 114,152
Natural-gas liquids:								
Natural gasoline and cycle products, thousand gallons	876,902	84,615	843,378	81,355	853,045	68,485	834,258	68,023
LP-gases, do	410,232	21,332	390,743	20,421	342,992	18,678	396,331	21,260
Peat	18,918	215	35,916	424	28,617	374	34,604	449
Perlite	15,119	135	15,109	113	14,883	114	(6)	(6)
Petroleum (crude), thousand 42-gallon barrels	350,754	918,975	339,646	1,035,920	313,672	909,649	[7] 307,327	[7] 783,684
Pumice, thousand short tons	634	2,334	459	1,510	377	1,670	574	2,162
Salt (common), do	1,444	7,606	1,330	8,721	1,297	(6)	1,388	(6)
Sand and gravel, do	86,447	96,526	78,983	87,030	84,137	95,340	87,945	108,909
Silver (recoverable content of ores, etc.), thousand troy ounces	938	849	522	473	188	170	173	156
Stone, thousand short tons	32,583	46,109	41,351	53,591	32,423	48,345	32,134	49,090
Talc, pyrophyllite and soapstone	153,710	1,419	133,915	1,526	[5] 129,638	[5] 1,339	148,266	1,500
Tungsten concentrate, 60-percent WO_3 basis	3,719	13,449	1,750	2,735	(6)	(6)	(6)	(6)
Wollastonite	-----	-----	-----	-----	1,652	17	(6)	(6)
Zinc (recoverable content of ores, etc.)	8,049	2,205	2,969	689	51	10	78	18
Value of items that cannot be disclosed: Asbestos, bromine, calcium-magnesium chloride, carbon dioxide (1956–57, 1959), masonry cement, clay (kaolin 1957), diatomite, fluorspar (1957–58), abrasive garnet (1956), iodine, lithium minerals (1958–59), magnesite (1956, 1958–59), mica (1956–58), molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate (1956–57), sodium carbonate and sulfate, strontium minerals (1956–57, 1959), sulfur ore, uranium ore, and values indicated by footnote 6	-----	63,654	-----	65,352	-----	[8] 68,564	-----	73,374
Total California [9]	-----	1,543,978	-----	1,650,035	-----	[8] 1,500,367	-----	1,424,039

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

COLORADO

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate……gross weight	163	$88	182	$91	134	$58	124	$58
Carbon dioxide, natural……thousand cubic feet	(6)	(6)	(6)	(6)	(6)	(6)	175,223	(6)
Clays……thousand short tons	523	1,215	403	978	449	1,111	417	1,160
Coal……do	3,502	19,832	3,594	21,831	2,974	19,305	3,294	21,034
Columbium-tantalum concentrate [14]……pounds	52	(12)	103	(12)	2,280	7	----------	----------
Copper (recoverable content of ores, etc.)	4,228	3,594	5,115	3,079	4,193	2,206	2,940	1,805
Feldspar……long tons	47,014	327	43,818	307	34,648	237	(6)	(6)
Gem stones	(13)	30	(13)	35	(13)	38	(13)	43
Gold (recoverable content of ores, etc.)……troy ounces	97,668	3,418	87,928	3,078	79,539	2,784	61,097	2,138
Gypsum……thousand short tons	88	353	(6)	(6)	103	341	106	385
Iron ore (usable)……thousand long tons, gross weight	(6)	(6)	(6)	(6)	(6)	(6)	11	78
Lead (recoverable content of ores, etc.)	19,856	6,235	21,003	6,007	14,112	3,302	12,907	2,969
Lime……thousand short tons	----------	----------	2	45	(6)	(6)	(6)	(6)
Manganese ore (35 percent or more Mn)……gross weight	----------	----------	175	14	210	17	1,218	102
Mica:								
Scrap	517	7	312	6	387	6	68	1
Sheet……pounds	8	(12)	14	(12)	----------	----------	----------	----------
Natural gas……million cubic feet	54,205	5,312	95,259	9,526	82,464	8,659	[7] 98,600	[7] 10,600
Natural-gas liquids:								
Natural gasoline……thousand gallons	(6)	(6)	(6)	(6)	49,505	3,410	47,424	2,811
LP-gases……do	(6)	(6)	(6)	(6)	68,027	3,343	77,637	3,671
Peat	----------	----------	3,559	(6)	7,143	41	6,674	35
Petroleum (crude)……thousand 42-gallon barrels	58,516	162,674	54,982	166,046	48,736	145,721	[7] 46,150	[7] 133,835
Pumice……thousand short tons	50	109	25	53	34	65	40	66
Pyrites……thousand long tons	(6)	(6)	62	(6)	67	359	(6)	(6)
Rare-earth and thorium concentrates	16	23	749	24	650	35	9	1
Salt (common)……thousand short tons	4	18	(6)	(6)	(6)	(6)	(6)	(6)
Sand and gravel……do	15,152	11,082	16,400	13,994	20,626	17,842	20,897	18,817
Silver (recoverable content of ores, etc.)……thousand troy ounces	2,285	2,068	2,788	2,523	2,056	1,860	1,341	1,213
Stone……thousand short tons	2,250	5,217	2,438	4,168	2,930	4,943	2,824	5,537
Tin (content of ore and concentrate)……long tons	----------	----------	----------	----------	----------	----------	50	60
Tungsten concentrate……60-percent WO_3 basis	873	3,010	45	55	(6)	(6)	(6)	(6)
Uranium ore	496,517	12,410	740,055	15,605	939,706	22,486	1,044,089	[8] 22,546
Vanadium……thousand pounds	5,582	(6)	6,264	(6)	4,791	(6)	5,897	(6)
Zinc (recoverable content of ores, etc.)	40,246	11,027	47,000	10,904	37,132	7,575	35,388	8,139
Value of items that cannot be disclosed: Carbon dioxide, cement, fluorspar, molybdenum, perlite, and values indicated by footnote 6	----------	75,632	----------	81,907	----------	62,855	----------	79,229
Total Colorado [9]	----------	321,908	----------	338,504	----------	[5] 306,561	----------	313,438

CONNECTICUT

Beryllium concentrate……gross weight..	(6)	(6)	(6)	(6)	(6)	(6)	13	$8
Clays……thousand short tons..	338	$390	308	$409	199	$299	280	368
Gem stones……	------	------	(13)	(6)	(13)	3	(13)	5
Lime……thousand short tons..	40	609	30	503	29	464	(6)	(6)
Mica, sheet……pounds..	310	2	(6)	(6)	(6)	(13)	------	------
Peat……	3,190	13	2,004	11	1,764	11	2,090	13
Sand and gravel……thousand short tons..	4,369	4,101	4,777	5,042	5,019	5,479	4,749	4,912
Stone……do....	4,428	[8] 6,590	6,199	10,040	4,223	6,863	4,462	7,088
Value of items that cannot be disclosed: Feldspar, stone (dimension limestone 1956), and values indicated by footnote 6. Excludes limestone used in manufacturing lime (1959)……	------	124	------	119	------	89	------	536
Total Connecticut……	------	[9] 11,737	------	16,055	------	[9] 13,128	------	12,930

DELAWARE

Sand and gravel……thousand short tons..	1,160	$967	974	$860	1,090	$962	1,241	$1,071
Stone……do....	83	232	(6)	(6)	(6)	(6)	(6)	(6)
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 6……	------	33	------	182	------	180	------	213
Total Delaware……	------	1,232	------	1,042	------	1,142	------	1,284

FLORIDA

Clays……thousand short tons..	432	$5,826	422	$6,067	450	$5,808	[4] 245	[4] $6,171
Gem stones……	(13)	(6)	------	------	------	------	(13)	3
Lime……thousand short tons..	40	490	(6)	(6)	(6)	(6)	111	1,238
Natural gas……million cubic feet..	35	3	34	4	35	5	[7] 34	[7] 6
Peat……	58,496	203	37,844	195	36,438	165	34,446	158
Petroleum (crude)……thousand 42-gallon barrels..	479	(6)	461	(6)	449	(6)	[7] 424	(6)
Phosphate rock……thousand long tons..	11,822	74,290	10,191	64,789	10,851	68,951	11,564	71,208
Sand and gravel……thousand short tons..	5,815	5,034	6,753	6,148	5,490	4,389	6,674	5,177
Stone……do....	18,779	25,183	21,786	30,467	[8] 23,549	[8] 30,983	[8] 26,917	[8] 35,940
Titanium concentrates……thousand short tons, gross weight..	(6)	(6)	263	10,643	190	5,495	262	7,196
Zirconium concentrate……	43,794	2,160	56,802	1,976	30,302	1,018	(6)	(6)
Value of items that cannot be disclosed: Cement, clays (kaolin and miscellaneous clay 1959), abrasive garnet (1956), magnesium compounds (1959), rare-earth metals concentrates, staurolite (1957–59), stone (dimension limestone 1958–59), and values indicated by footnote 6……	------	28,452	------	[8] 22,514	------	[8] 28,510	------	40,034
Total Florida [9]……	------	140,490	------	140,467	------	[5] 142,114	------	163,447

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

GEORGIA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays .... thousand short tons	3,047	$29,501	2,707	$30,120	2,942	$31,253	3,352	$36,232
Coal .... do	8	42	13	63	9	44	7	34
Iron ore (usable) .... thousand long tons, gross weight	357	1,609	443	2,109	209	1,008	186	945
Manganese ore (35 percent or more Mn) .... gross weight	(6)	(6)	(6)	(6)	(6)	(6)	1,547	(6)
Manganiferous ore (5 to 35 percent Mn) .... do	(6)	(6)	2,203	(6)	(6)	(6)	(6)	(6)
Mica (sheet) .... pounds	20,149	150	16,933	158	15,102	82	18,461	119
Peat	6,225	48	4,690	45	4,491	(6)	4,288	(6)
Sand and gravel .... thousand short tons	2,426	2,183	2,127	2,096	2,631	2,693	2,909	2,982
Stone .... do	[8] 9,196	[8] 20,714	[8] 9,065	[8] 15,833	12,129	31,108	13,771	35,973
Talc and soapstone	57,916	122	49,372	106	(6)	(6)	53,692	107
Value of items that cannot be disclosed: Barite, bauxite, beryllium concentrate (1956-57), cement, feldspar, gem stones, iron ore (pigment material), scrap mica, slate (1956-57), stone (crushed marble and crushed sandstone 1956, dimension and crushed marble and crushed sandstone 1957), and minerals indicated by footnote 6	----------	14,558	----------	20,081	----------	10,145	----------	10,979
Total Georgia [9]	----------	67,912	----------	69,799	----------	75,106	----------	86,262

HAWAII

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays .... thousand short tons	2	$2	2	$3	(6)	(6)	(6)	(6)
Lime .... do	10	306	8	271	8	$260	(6)	(6)
Pumice .... do	59	92	266	493	260	481	276	$548
Salt .... do	(10)	18	(10)	15	(10)	(6)	----------	----------
Sand and gravel .... do	193	503	286	538	438	1,112	463	1,253
Stone .... do	3,494	6,076	2,585	4,632	2,377	4,446	3,034	5,480
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 6	----------	----------	----------	----------	----------	13	----------	363
Total Hawaii [11]	----------	6,972	----------	5,930	----------	6,298	----------	7,630

IDAHO

Antimony ore and concentrate........antimony content..	549	(6)	664	(6)	677	(6)	678	(6)
Beryllium concentrate........gross weight..	--------	--------	1	(12)	--------	--------	--------	--------
Clays [4]........thousand short tons..	23	$13	23	$16	27	$20	39	$33
Cobalt (content of concentrate)........thousand pounds..	2,385	(6)	2,618	(6)	3,078	(6)	1,141	(6)
Columbium-tantalum concentrate........pounds..	215,900	(6)	364,768	(6)	422,612	(6)	189,263	(6)
Copper (recoverable content of ores, etc.)........	6,656	5,658	7,912	4,763	9,846	5,179	8,713	5,350
Gem stones........	(13)	(6)	(13)	(6)	(13)	(6)	(13)	5
Gold (recoverable content of ores, etc.)........troy ounces..	9,210	322	12,301	431	15,896	556	10,479	367
Iron ore (usable)........thousand long tons..	1	(6)	(6)	(6)	1	14	6	56
Lead (recoverable content of ores, etc.)........	64,321	20,197	71,637	20,488	53,603	12,543	62,395	14,351
Mercury........76-pound flasks..	3,394	882	2,260	558	2,625	601	1,961	446
Mica:								
Scrap........	--------	--------	--------	--------	1	(12)	--------	--------
Sheet........pounds..	--------	--------	1,240	9	1,968	14	(6)	(6)
Nickel (content of ore and concentrate)........	49	(6)	37	55	29	(6)	(6)	(6)
Phosphate rock........thousand long tons..	1,438	6,539	1,307	5,684	1,291	5,652	1,610	7,412
Pumice........thousand short tons..	102	206	100	168	108	172	93	137
Rare-earth metals concentrates........	303	(6)	366	(6)	692	(6)	522	80
Sand and gravel........thousand short tons..	7,874	5,661	6,665	5,274	[5] 6,879	[5] 6,404	9,184	8,080
Silver (recoverable content of ores, etc.)........thousand troy ounces..	13,472	12,193	15,067	13,637	15,953	14,438	16,637	15,057
Stone........thousand short tons..	1,791	2,752	1,542	2,759	[5] 1,391	[5] 1,794	1,079	1,931
Titanium concentrate........gross weight..	48,619	261	28,397	(6)	2,223	(6)	(6)	(6)
Tungsten concentrate........60-percent WO_3 basis..	582	(6)	35	(6)	(6)	(6)	--------	--------
Uranium ore........	--------	--------	(6)	(6)	(6)	(6)	3,374	30
Zinc (recoverable content of ores, etc.)........	49,561	13,580	57,831	13,417	49,725	10,144	55,699	12,811
Value of items that cannot be disclosed: Barite, cement, clays (fire clay, bentonite 1958), abrasive garnet, gypsum (1958–59), peat (1957–59), zirconium concentrate (1958), and values indicated by footnote 6. Excludes limestone used in manufacturing cement........	--------	6,885	--------	6,243	--------	[5] 7,117	--------	4,063
Total Idaho........	--------	75,150	--------	73,502	--------	[5] 64,648	--------	70,209

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

ILLINOIS

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement.....thousand 376-pound barrels..	9,301	$27,264	8,575	$26,356	9,618	$30,858	9,925	$31,794
Clays.....thousand short tons..	2,258	4,005	1,917	5,155	2,335	5,910	2,229	4,950
Coal.....do....	48,102	184,678	46,993	187,908	43,912	176,614	45,466	184,412
Fluorspar.....	178,254	8,470	169,939	8,827	152,087	7,931	112,469	5,908
Gem stones.....	-----	-----	(13)	2	(13)	1	(13)	1
Lead (recoverable content of ores, etc.).....	3,832	1,203	2,970	849	1,610	377	2,570	591
Natural gas.....million cubic feet..	6,177	933	9,647	1,495	12,983	1,921	[7] 12,500	[7] 1,900
Natural-gas liquids:								
Natural gasoline and cycle products.....thousand gallons..	(6)	(6)	(6)	(6)	22,380	1,645	(6)	(6)
LP-gases.....do....	(6)	(6)	(6)	(6)	353,129	20,866	(6)	(6)
Peat.....	14,451	158	11,480	106	11,588	72	9,117	72
Petroleum (crude).....thousand 42-gallon barrels..	82,346	241,274	77,083	240,499	80,275	240,825	78,435	[7] 234,521
Sand and gravel.....thousand short tons..	31,239	33,254	30,151	32,572	29,866	33,453	30,241	33,717
Silver (recoverable content of ores, etc.).....thousand troy ounces..	2	1	-----	-----	-----	-----	-----	-----
Stone.....thousand short tons..	31,855	40,859	31,861	41,835	35,016	44,245	35,294	45,081
Zinc (recoverable content of ores, etc.).....	24,039	6,587	22,185	5,147	24,940	5,088	26,815	6,167
Value of items that cannot be disclosed: Lime, tripoli, and values indicated by footnote 6.....	-----	26,048	-----	27,898	-----	9,573	-----	30,897
Total Illinois [9].....	-----	572,247	-----	576,324	-----	[5] 576,862	-----	577,372

INDIANA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones.....	3	$5	4	$8	10	$10	5	$13
Cement.....thousand 376-pound barrels..	(6)	(6)	[2] 12,598	[2] 40,742	[2] 14,730	[2] 48,858	(6)	(6)
Clays.....thousand short tons..	2,051	3,457	1,475	2,569	1,370	2,477	1,692	2,915
Coal.....do....	17,089	64,061	15,841	62,055	15,022	58,506	14,804	59,954
Lime.....do....	(10)	1	-----	-----	-----	-----	-----	-----
Marl, calcareous (except for cement).....	99,561	66	(16)	(16)	(16)	(16)	(16)	(16)
Natural gas.....million cubic feet..	791	96	671	88	378	59	[7] 600	[7] 100
Peat.....	11,383	79	13,805	130	12,106	145	15,393	202
Petroleum (crude).....thousand 42-gallon barrels..	11,513	33,733	12,662	39,632	11,864	35,711	[7] 12,003	[7] 35,649
Sand and gravel.....thousand short tons..	18,302	15,432	16,750	14,206	16,862	15,045	20,357	17,924
Stone.....do....	14,700	31,575	14,460	33,094	15,394	31,974	18,544	37,682
Value of items that cannot be disclosed: Cement (masonry and natural cement 1957–58), gypsum, and values indicated by footnote 6.....	-----	50,284	-----	[5] 7,675	-----	[5] 7,539	-----	56,048
Total Indiana [9].....	-----	196,439	-----	198,034	-----	197,677	-----	207,701

IOWA

Cement……thousand 376-pound barrels	10,760	$32,823	10,823	$34,881	12,675	$41,741	13,170	$44,048
Clays……thousand short tons	[4] 852	[4] 1,078	[4] 752	[4] 944	[4] 837	[4] 1,054	912	1,168
Coal……do	1,358	4,732	1,312	4,543	1,179	4,147	1,180	4,214
Gypsum……do	1,177	3,919	1,123	3,773	1,230	4,491	1,318	5,587
Peat……	27,375	(6)	(6)	(6)	(6)	(6)	----------	----------
Sand and gravel……thousand short tons	12,895	9,525	12,042	8,927	12,411	10,965	13,484	11,658
Stone……do	14,035	17,256	15,214	18,768	21,045	26,138	20,501	25,759
Value of items that cannot be disclosed: Fire clay (1956–58), lime, and values indicated by footnote 6……	----------	467	----------	614	----------	633	----------	520
Total Iowa [9]……	----------	66,529	----------	68,986	----------	85,356	----------	88,557

KANSAS

Cement [3]……thousand 376-pound barrels	10,598	$30,696	8,178	$24,814	9,600	$30,047	10,405	$32,282
Clays……thousand short tons	977	1,169	909	1,240	875	1,145	1,021	1,271
Coal……do	884	3,856	749	3,331	823	3,711	772	3,607
Gem stones……	----------	----------	----------	----------	----------	----------	(13)	1
Helium……thousand cubic feet	45,035	698	36,743	570	27,888	432	21,643	343
Lead (recoverable content of ores, etc.)……	7,635	2,398	4,257	1,217	1,299	304	481	111
Natural gas……million cubic feet	526,091	59,448	586,690	66,883	561,816	64,047	[7] 565,000	[7] 65,000
Natural-gas liquids:								
Natural gasoline……thousand gallons	105,482	5,928	119,247	6,569	110,293	6,229	107,814	5,576
LP-gases……do	90,287	3,843	103,494	4,042	115,175	5,193	124,874	6,658
Petroleum (crude)……thousand 42-gallon barrels	124,204	346,529	123,614	372,078	119,942	359,826	[7] 119,514	[7] 347,786
Salt (common)……thousand short tons	1,004	9,167	1,018	10,353	1,073	11,348	1,123	13,670
Sand and gravel……do	12,515	8,022	9,345	6,175	10,317	6,769	11,334	7,937
Stone……do	13,434	15,703	[8] 10,412	[8] 11,926	[8] 12,424	[8] 15,036	[8] 13,999	[8] 17,108
Zinc (recoverable content of ores, etc.)……	28,665	7,854	15,859	3,679	4,421	902	1,017	234
Value of items that cannot be disclosed: Natural cement, gypsum, pumice, stone (dimension and crushed sandstone, 1957–59), and values indicated by footnote 6……	----------	1,465	----------	1,191	----------	1,627	----------	2,012
Total Kansas [9]……	----------	493,770	----------	511,513	----------	[5] 503,788	----------	500,464

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

KENTUCKY

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	------------	------------	------------	------------	------------	------------	26,598	$335
Clays ... thousand short tons	905	$4,079	894	$3,915	737	$2,957	984	3,595
Coal ... do	74,555	331,358	74,667	338,109	66,312	289,385	62,810	270,139
Fluorspar	14,865	608	20,626	979	25,861	1,201	18,579	887
Lead (recoverable content of ores, etc.)	228	72	411	118	516	121	409	94
Natural gas ... million cubic feet	73,687	17,022	70,024	16,666	72,248	17,412	[7] 72,400	[7] 17,600
Natural-gas liquids:								
Natural gasoline ... thousand gallons	35,275	2,414	34,956	1,935	37,926	2,165	35,868	2,133
LP-gases ... do	248,992	8,709	176,033	7,403	150,655	8,491	213,171	12,267
Petroleum (crude) ... thousand 42-gallon barrels	17,628	51,297	17,029	53,301	17,509	51,652	[7] 26,343	[7] 74,024
Sand and gravel ... thousand short tons	5,684	5,974	4,482	4,556	4,685	4,835	5,081	5,568
Stone ... do	11,553	15,324	12,718	16,714	12,597	17,360	[8] 16,063	[8] 22,215
Zinc (recoverable content of ores, etc.)	417	114	837	194	1,258	257	673	155
Value of items that cannot be disclosed: Native asphalt (1956–57), cement, iron ore (1956), stone (crushed sandstone 1959), and silver	------------	7,079	------------	6,211	------------	7,059	------------	8,202
Total Kentucky [9]	------------	443,168	------------	449,390	------------	402,121	------------	416,391
LOUISIANA								
Clays [4] ... thousand short tons	785	$785	642	$642	755	$755	904	$904
Gypsum ... do	276	598	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ... million cubic feet	1,886,302	215,038	2,078,901	232,837	2,451,587	316,255	[7] 2,480,400	[7] 324,900
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	773,949	62,394	775,009	63,956	783,099	50,371	846,110	60,295
LP-gases ... do	305,222	14,727	335,142	14,888	410,869	21,435	540,046	25,877
Petroleum (crude) ... thousand 42-gallon barrels	299,421	877,951	329,896	1,094,402	313,891	1,023,517	[7] 354,611	[7] 1,120,115
Salt (common) ... thousand short tons	3,704	17,695	3,461	18,944	3,442	18,960	4,807	20,918
Sand and gravel ... do	15,074	18,640	12,579	14,730	15,061	17,119	16,052	20,111
Stone ... do	4,405	6,674	4,383	7,152	5,453	9,532	5,670	10,874
Sulfur (Frasch-process) ... thousand long tons	2,239	59,330	2,156	52,690	2,028	47,651	2,252	52,779
Value of items that cannot be disclosed: Cement, clay (bentonite), lime, and values indicated by footnote 6	------------	16,348	------------	18,966	------------	20,475	------------	20,286
Total Louisiana [15]	------------	1,288,116	------------	1,517,522	------------	[5] 1,523,370	------------	1,654,493

MAINE

Beryllium concentrate........gross weight..	12	$7	4	$2	(11)	(12)	3	$2
Clays........thousand short tons..	26	23	30	28	23	$26	25	26
Feldspar........long tons..	22,219	144	14,330	92	13,034	83	(6)	(6)
Gem stones........	(13)	1	(13)	1	(13)	5	(13)	10
Lime........thousand short tons..	12	179	(6)	(6)	(6)	(6)	----------	----------
Mica:								
Scrap........	114	3	6	(12)	104	3	157	4
Sheet........pounds..	19,913	146	25,453	202	20,097	278	22,360	237
Peat........	(6)	(6)	3,770	175	(6)	(6)	(6)	(6)
Sand and gravel........thousand short tons..	7,196	3,085	8,037	3,099	8,941	3,746	9,452	3,644
Stone........do....	947	2,787	889	3,076	880	2,760	819	2,766
Value of items that cannot be disclosed: Cement, columbium-tantalum concentrate (1956), slate (1956-57), and values indicated by footnote 6....	----------	6,912	----------	6,617	----------	6,363	----------	7,050
Total Maine [15]........	----------	12,728	----------	12,711	----------	12,574	----------	13,278

MARYLAND

Clays [4]........thousand short tons..	636	$1,046	631	$963	605	$815	661	$944
Coal........do....	669	2,685	748	3,082	838	3,161	842	3,188
Gem stones........	(13)	(6)	(13)	(6)	(13)	2	(13)	2
Lime........thousand short tons..	53	581	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas........million cubic feet..	4,619	1,169	4,649	1,218	4,266	1,148	[7] 5,400	[7] 1,500
Sand and gravel........thousand short tons..	10,147	12,395	8,679	11,594	[5] 8,513	[5] 11,368	10,034	12,983
Stone........do....	6,229	13,305	6,140	13,392	6,721	14,387	7,445	15,476
Value of items that cannot be disclosed: Beryllium concentrate (1956-57), cement, ball clay, greensand marl, mica (1957), potassium salts, talc and soapstone, and values indicated by footnote 6........	----------	10,729	----------	10,664	----------	16,224	----------	21,416
Total Maryland [9]........	----------	40,534	----------	39,625	----------	[5] 45,735	----------	53,508

MASSACHUSETTS

Clays........thousand short tons..	128	$213	78	$98	85	$111	101	$229
Lime........do....	134	2,093	137	2,233	139	2,121	144	2,289
Peat........	300	(6)	600	(6)	1,014	(6)	773	(6)
Sand and gravel........thousand short tons..	10,189	9,520	9,900	9,691	10,620	10,035	13,210	11,786
Stone........do....	5,442	13,753	4,877	13,165	4,649	12,354	5,102	12,875
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 6........	----------	3	----------	6	----------	9	----------	7
Total Massachusetts [15]........	----------	25,085	----------	24,789	----------	23,887	----------	25,916

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

MICHIGAN

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement……thousand 376-pound barrels	21,880	$67,798	22,045	$71,606	20,912	$70,432	23,026	77,324
Clays……thousand short tons	2,110	2,401	1,842	1,982	1,663	1,813	1,771	1,937
Copper (recoverable content of ores, etc.)	61,526	52,297	58,400	35,157	58,005	30,511	55,300	33,954
Gypsum……thousand short tons	1,716	5,861	1,386	4,823	1,331	4,824	1,721	6,595
Iron ore (usable)……thousand long tons, gross weight	12,536	98,111	13,123	111,484	8,111	69,845	7,247	62,921
Lime……thousand short tons	(6)	(6)	(6)	(6)	(6)	(6)	862	11,748
Manganiferous ore (5 to 35 percent Mn)……gross weight	------	------	123,547	(6)	112,536	(6)	------	------
Marl, calcareous (except for cement)	157,246	95	(16)	(16)	(16)	(16)	(16)	(16)
Natural gas……million cubic feet	10,911	1,451	9,122	1,715	14,243	2,649	[7] 12,300	[7] 2,300
Peat	31,111	475	80,271	1,406	107,342	1,684	191,661	2,357
Petroleum (crude)……thousand 42-gallon barrels	10,740	30,824	10,169	31,117	9,308	27,366	[7] 10,438	[7] 30,688
Salt (common)……thousand short tons	5,548	35,644	5,225	41,073	4,267	33,018	4,485	35,725
Sand and gravel……do	42,150	35,146	41,838	35,144	39,871	34,616	48,052	41,193
Silver (recoverable content of ores, etc.)……thousand troy ounces	380	344	430	389	------	------	------	------
Stone……thousand short tons	33,999	31,010	34,495	34,176	27,188	26,846	30,095	30,379
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones, magnesium compounds, natural-gas liquids, potassium salts, and values indicated by footnote 6	------	38,737	------	40,324	------	[8] 45,558	------	49,371
Total Michigan [9]	------	394,556	------	404,673	------	[8] 343,487	------	379,244

MINNESOTA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays……thousand short tons	[4] 80	[4] $91	[4] 97	[4] $113	92	$150	153	$267
Iron ore (usable)……thousand long tons, gross weight	62,637	461,904	67,656	541,474	42,503	354,528	36,109	306,920
Manganiferous ore (5 to 35 percent Mn)……gross weight	633,919	(6)	692,295	(6)	370,603	(6)	429,102	(6)
Marl, calcareous (except for cement)	875	(6)	(16)	(16)	(16)	(16)	(16)	(16)
Peat	(6)	(6)	1,300	(6)	(6)	(6)	------	------
Sand and gravel……thousand short tons	28,197	18,254	28,493	19,385	29,634	21,680	28,486	20,726
Stone……do	[8] 3,084	[8] 7,552	[8] 2,968	[8] 8,175	3,519	9,560	3,639	9,461
Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1956–57), gem stones, lime, manganese ore (1956–57), stone (crushed sandstone, 1956–57, calcareous marl 1957), and values indicated by footnote 6	------	13,443	------	15,107	------	10,154	------	9,993
Total Minnesota [15]	------	501,027	------	584,038	------	395,880	------	347,178

MISSISSIPPI

Clays.......thousand short tons..	613	$3,590	616	$3,635	576	$3,338	747	$4,064
Iron ore.......thousand long tons..	(17)	(12)	(17)	1	(17)	(12)	------------	------------
Natural gas.......million cubic feet..	185,137	18,143	169,967	17,507	160,143	22,260	[7] 178,000	[7] 24,900
Natural-gas liquids:								
Natural gasoline and cycle products.......thousand gallons..	24,829	1,751	25,152	1,469	25,738	1,658	23,207	1,495
LP-gases.......do....	10,698	580	10,044	472	9,208	503	8,141	465
Petroleum (crude).......thousand 42-gallon barrels..	40,824	100,019	38,922	113,263	39,512	113,004	[7] 47,928	[7] 136,116
Sand and gravel.......thousand short tons..	5,315	4,701	5,172	4,344	6,545	6,240	7,520	7,743
Stone.......do....	656	656	[8] 60	[8] 54	[8] 102	[8] 92	[8] 126	[8] 114
Value of items that cannot be disclosed: Certain metals and nonmetals....	------------	4,174	------------	4,694	------------	4,820	------------	6,751
Total Mississippi[15].......	------------	133,098	------------	144,950	------------	[5] 151,411	------------	181,086

MISSOURI

Barite.......	381,642	$4,462	317,350	$3,938	199,268	$2,666	296,093	$3,924
Cement[3].......thousand 376-pound barrels..	12,012	36,888	10,794	34,307	12,116	40,657	13,947	46,974
Clays.......thousand short tons..	2,658	8,016	2,648	7,648	2,060	5,986	2,635	6,898
Coal.......do....	3,283	13,223	2,976	12,691	2,592	11,111	2,748	11,937
Copper (recoverable content of ores, etc.).......	1,890	1,606	1,604	966	1,429	752	1,065	654
Iron ore (usable).......thousand long tons, gross weight..	365	(6)	530	4,625	387	3,820	349	3,278
Lead (recoverable content of ores, etc.).......	123,783	38,868	126,345	36,135	113,123	26,471	105,165	24,188
Lime.......thousand short tons..	1,482	15,814	1,393	16,475	1,173	14,136	1,324	15,714
Natural gas.......million cubic feet..	12	2	12	2	------------	------------	------------	------------
Nickel (content of ore and concentrate).......	(6)	(6)	(6)	(6)	763	(6)	(6)	(6)
Petroleum (crude).......thousand 42-gallon barrels..	65	176	65	(6)	84	(6)	------------	------------
Sand and gravel.......thousand short tons..	9,585	10,117	8,480	8,942	8,972	9,728	10,279	11,406
Silver (recoverable content of ores, etc.).......thousand troy ounces..	295	267	184	166	251	227	340	308
Stone.......thousand short tons..	24,578	33,577	22,098	29,836	24,276	32,878	26,939	36,435
Zinc (recoverable content of ores, etc.).......	4,380	1,200	2,951	685	362	74	92	21
Values of items that cannot be disclosed: Native asphalt, masonry cement (1956–57), cobalt, gem stones (1957–59), iron oxide pigment materials (1956), manganese ore (1957–58), and values indicated by footnote 6.......	------------	5,897	------------	2,793	------------	[5] 2,037	------------	2,108
Total Missouri[9].......	------------	163,693	------------	152,913	------------	[5] 144,120	------------	157,009

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

KENTUCKY

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	------------	------------	------------	------------	------------	------------	26,598	$335
Clays ... thousand short tons	905	$4,079	894	$3,915	737	$2,957	984	3,595
Coal ... do	74,555	331,358	74,667	338,109	66,312	289,385	62,810	270,139
Fluorspar	14,865	608	20,626	979	25,861	1,201	18,579	887
Lead (recoverable content of ores, etc.)	228	72	411	118	516	121	409	94
Natural gas ... million cubic feet	73,687	17,022	70,024	16,666	72,248	17,412	[7] 72,400	[7] 17,600
Natural-gas liquids:								
Natural gasoline ... thousand gallons	35,275	2,414	34,956	1,935	37,926	2,165	35,868	2,133
LP-gases ... do	248,992	8,709	176,033	7,403	150,655	8,491	213,171	12,267
Petroleum (crude) ... thousand 42-gallon barrels	17,628	51,297	17,029	53,301	17,509	51,652	[7] 26,343	[7] 74,024
Sand and gravel ... thousand short tons	5,684	5,974	4,482	4,556	4,685	4,835	5,081	5,568
Stone ... do	11,553	15,324	12,718	16,714	12,597	17,360	[8] 16,063	[8] 22,215
Zinc (recoverable content of ores, etc.)	417	114	837	194	1,258	257	673	155
Value of items that cannot be disclosed: Native asphalt (1956-57), cement, iron ore (1956), stone (crushed sandstone 1959), and silver	------------	7,079	------------	6,211	------------	7,059	------------	8,202
Total Kentucky [9]	------------	443,168	------------	449,390	------------	402,121	------------	416,391

LOUISIANA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays [4] ... thousand short tons	785	$785	642	$642	755	$755	904	$904
Gypsum ... do	276	598	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ... million cubic feet	1,886,302	215,038	2,078,901	232,837	2,451,587	316,255	[7] 2,480,400	[7] 324,900
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	773,949	62,394	775,009	63,956	783,099	50,371	846,110	60,295
LP-gases ... do	305,222	14,727	335,142	14,888	410,869	21,435	540,046	25,877
Petroleum (crude) ... thousand 42-gallon barrels	299,421	877,951	329,896	1,094,402	313,891	1,023,517	[7] 354,611	[7] 1,120,115
Salt (common) ... thousand short tons	3,704	17,695	3,461	18,944	3,442	18,960	4,807	20,918
Sand and gravel ... do	15,074	18,640	12,579	14,730	15,061	17,119	16,052	20,111
Stone ... do	4,405	6,674	4,383	7,152	5,453	9,532	5,670	10,874
Sulfur (Frasch-process) ... thousand long tons	2,239	59,330	2,156	52,690	2,028	47,651	2,252	52,779
Value of items that cannot be disclosed: Cement, clay (bentonite), lime, and values indicated by footnote 6	------------	16,348	------------	18,966	------------	20,475	------------	20,286
Total Louisiana [15]	------------	1,288,116	------------	1,517,522	------------	[5] 1,523,370	------------	1,654,493

NEBRASKA

Clays, thousand short tons	153	$154	134	$135	108	$110	131	$133
Gem stones	(13)	3	(13)	2	(13)	2	(13)	3
Natural gas, million cubic feet	13,541	2,844	14,249	2,280	11,405	1,711	[7] 19,100	[7] 2,900
Natural-gas liquids:								
Natural gasoline, thousand gallons	(6)	(6)	(6)	(6)	10,870	727	(6)	(6)
LP-gases, do	(6)	(6)	(6)	(6)	31,178	1,565	(6)	(6)
Petroleum (crude), thousand 42-gallon barrels	16,204	45,209	19,586	58,366	20,373	59,897	[7] 23,669	[7] 68,167
Sand and gravel, thousand short tons	10,350	7,404	7,944	5,889	10,441	7,945	11,202	8,301
Stone, do	3,063	4,142	3,065	3,749	3,555	4,747	3,236	5,235
Value of items that cannot be disclosed: Cement, pumice, and values indicated by footnote 6		12,771		13,670		14,603		17,679
Total Nebraska [9]		71,311		82,928		[8] 90,047		100,213

NEVADA

Antimony ore and concentrate, antimony content	13	(6)	29	$9	39	$8	10	$2
Barite	178,440	$1,067	109,663	721	59,407	405	91,298	623
Clays, thousand short tons	14	32	12	20	(6)	(6)	(6)	(6)
Copper (recoverable content of ores, etc.)	80,824	68,700	77,750	46,806	66,137	34,788	57,375	35,228
Fluorspar	(6)	(6)	(6)	(6)	12,338	340	16,743	407
Gem stones	(13)	50	(13)	100	(13)	100	(13)	100
Gold (recoverable content of ores, etc.), troy ounces	68,040	2,381	76,752	2,686	105,087	3,678	113,443	3,971
Gypsum, thousand short tons	790	2,701	674	(6)	686	2,306	818	2,738
Iron ore (usable), thousand long tons, gross weight	917	5,021	904	5,341	594	3,149	698	3,712
Lead (recoverable content of ores, etc.)	6,384	2,004	5,979	1,710	4,150	971	1,357	312
Manganese ore (35 percent or more Mn), gross weight	121,482	(6)	129,046	(6)	127,322	7,566	56,586	3,917
Mercury, 76-pound flasks	5,859	1,523	6,313	1,559	7,336	1,681	7,156	1,628
Petroleum, thousand 42-gallon barrels	64	111	44	76	40	69	[7] 32	(6)
Pumice, thousand short tons	12	34	(6)	(6)	(6)	(6)	(6)	(6)
Sand and gravel, do	4,687	4,569	5,233	5,190	5,503	5,311	6,436	7,522
Silver (recoverable content of ores, etc.), thousand troy ounces	994	899	959	868	933	844	611	553
Stone, thousand short tons	1,401	2,281	925	1,585	813	1,335	840	1,587
Talc and soapstone	10,540	98	7,467	57	5,391	41	5,824	50
Tungsten concentrate, 60-percent WO_3 basis	5,400	19,263	1,196	1,676	(6)	(6)	(6)	(6)
Zinc (recoverable content of ores, etc.)	7,488	2,052	5,292	1,228	91	19	217	50
Value of items that cannot be disclosed: Brucite, diatomite, lime, magnesite, calcareous marl (1956), molybdenum, perlite, salt, sulfur ore, uranium ore, and values indicated by footnote 6		14,446		16,756		6,020		8,454
Total Nevada [15]		126,681		86,023		68,293		70,159

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

MICHIGAN

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement ... thousand 376-pound barrels	21,880	$67,798	22,045	$71,606	20,912	$70,432	23,026	77,324
Clays ... thousand short tons	2,110	2,401	1,842	1,982	1,663	1,813	1,771	1,937
Copper (recoverable content of ores, etc.)	61,526	52,297	58,400	35,157	58,005	30,511	55,300	33,954
Gypsum ... thousand short tons	1,716	5,861	1,386	4,823	1,331	4,824	1,721	6,595
Iron ore (usable) ... thousand long tons, gross weight	12,536	98,111	13,123	111,484	8,111	69,845	7,247	62,921
Lime ... thousand short tons	([6])	([6])	([6])	([6])	([6])	([6])	862	11,748
Manganiferous ore (5 to 35 percent Mn) ... gross weight	------	------	123,547	([6])	112,536	([6])	------	------
Marl, calcareous (except for cement)	157,246	95	([16])	([16])	([16])	([16])	([16])	([16])
Natural gas ... million cubic feet	10,911	1,451	9,122	1,715	14,243	2,649	[7] 12,300	[7] 2,300
Peat	31,111	475	80,271	1,406	107,342	1,684	191,661	2,357
Petroleum (crude) ... thousand 42-gallon barrels	10,740	30,824	10,169	31,117	9,308	27,366	[7] 10,438	[7] 30,688
Salt (common) ... thousand short tons	5,548	35,644	5,225	41,073	4,267	33,018	4,485	35,725
Sand and gravel ... do	42,150	35,146	41,838	35,144	39,871	34,616	48,052	41,193
Silver (recoverable content of ores, etc.) ... thousand troy ounces	380	344	430	389	------	------	------	------
Stone ... thousand short tons	33,999	31,010	34,495	34,176	27,188	26,846	30,095	30,379
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, gem stones, magnesium compounds, natural-gas liquids, potassium salts, and values indicated by footnote 6	------	38,737	------	40,324	------	[5] 45,558	------	49,371
Total Michigan [9]	------	394,556	------	404,673	------	[5] 343,487	------	379,244
MINNESOTA								
Clays ... thousand short tons	[4] 80	[4] $91	[4] 97	[4] $113	92	$150	153	$267
Iron ore (usable) ... thousand long tons, gross weight	62,637	461,904	67,656	541,474	42,503	354,528	36,109	306,920
Manganiferous ore (5 to 35 percent Mn) ... gross weight	633,919	([6])	692,295	([6])	370,603	([6])	429,102	([6])
Marl, calcareous (except for cement)	875	([6])	([16])	([16])	([16])	([16])	([16])	([16])
Peat	([6])	([6])	1,300	([6])	([6])	([6])	------	------
Sand and gravel ... thousand short tons	28,197	18,254	28,493	19,385	29,634	21,680	28,486	20,726
Stone ... do	[8] 3,084	[8] 7,552	[8] 2,968	[8] 8,175	3,519	9,560	3,639	9,461
Value of items that cannot be disclosed: Abrasive stones, cement, fire clay (1956–57), gem stones, lime, manganese ore (1956–57), stone (crushed sandstone, 1956–57, calcareous marl 1957), and values indicated by footnote 6	------	13,443	------	15,107	------	10,154	------	9,993
Total Minnesota [15]	------	501,027	------	584,038	------	395,880	------	347,178

NEW MEXICO

Barite	4,059	$81	4,441	$98	(6)	(6)	320	$6
Beryllium concentrate ... gross weight	31	(6)	29	15	27	$16	11	6
Clays ... thousand short tons	40	95	33	83	[4] 40	[4] 73	[4] 45	[4] 77
Coal ... do	158	923	137	829	117	719	149	837
Columbium-tantalum concentrate ... pounds	95	(12)	866	1	------	------	------	------
Copper (recoverable content of ores, etc.)	74,345	63,193	67,472	40,618	55,540	29,214	39,688	24,369
Fluorspar	------	------	------	------	------	------	200	7
Gem stones	(13)	30	(13)	30	(13)	28	(13)	39
Gold (recoverable content of ores, etc.) ... troy ounces	3,275	115	3,212	112	3,378	118	3,155	110
Helium ... thousand cubic feet	76,072	1,350	69,336	1,189	29,793	502	16,903	264
Iron ore (usable) ... thousand long tons, gross weight	(6)	(6)	(17)	1	(17)	(6)	(17)	(6)
Lead (recoverable content of ores, etc.)	6,042	1,897	5,294	1,514	1,117	261	829	191
Lime ... thousand short tons	31	373	24	290	21	260	16	209
Manganese ore (35 percent or more Mn) ... gross weight	22,011	1,834	25,459	2,114	[5] 28,866	[5] 2,333	27,528	2,248
Manganiferous ore (5 to 35 percent Mn) ... do	38,782	(6)	42,535	152	(6)	(6)	(6)	(6)
Mica:								
Scrap	767	22	1,347	47	787	24	210	7
Sheet ... pounds	6,247	53	2,134	16	1,791	18	247	2
Natural gas ... million cubic feet	626,340	55,118	723,004	67,962	761,446	79,190	[7] 777,800	[7] 81,700
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	306,595	16,560	309,010	19,941	258,312	15,131	264,133	16,859
LP-gases ... do	308,218	11,065	375,930	13,046	458,178	17,331	552,257	22,320
Perlite	167,705	1,271	187,259	1,568	202,046	1,790	240,642	2,121
Petroleum (crude) ... thousand 42-gallon barrels	87,893	241,706	94,759	283,128	98,515	293,974	[7] 105,692	[7] 301,394
Potassium salts ... thousand short tons, K_2O equivalent	1,997	75,122	2,080	77,197	1,978	69,106	2,189	74,117
Pumice ... thousand short tons	292	667	321	756	507	959	493	1,023
Salt (common) ... do	58	501	53	429	31	275	36	322
Sand and gravel ... do	6,054	5,776	7,991	7,803	13,205	11,413	12,460	13,332
Silver (recoverable content of ores, etc.) ... thousand troy ounces	393	356	309	280	159	144	159	144
Stone ... thousand short tons	1,268	1,272	1,348	1,618	1,730	1,507	461	542
Tungsten ore and concentrate ... 60-percent WO_3 basis	(11)	2	------	------	------	------	------	------
Uranium ore	1,105,183	24,086	1,175,742	20,538	1,888,499	32,264	3,269,826	53,463
Zinc (recoverable content of ores, etc.)	35,010	9,593	32,680	7,582	9,034	1,843	4,636	1,066
Value of items that cannot be disclosed: Carbon dioxide, cement (1959), fire clay (1957–59), molybdenum, magnesium compounds, rare-earth metals concentrates (1956), vanadium, and values indicated by footnote 6	------	1,933	------	2,276	------	1,345	------	3,771
Total New Mexico [15]	------	514,903	------	551,155	------	[5] 559,777	------	600,269

See footnote at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

NEW YORK

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays ... thousand short tons	1,235	$1,508	1,002	$1,270	1,085	$1,419	1,309	$1,714
Emery	12,153	174	11,893	184	7,687	126	8,555	150
Gem stones	(13)	2	(13)	5	(13)	8	(13)	8
Gypsum ... thousand short tons	1,140	4,817	864	3,749	834	3,869	919	4,663
Iron ore (usable) ... thousand long tons, gross weight	3,188	41,094	3,329	44,567	1,944	25,683	2,044	28,050
Lead (recoverable content of ores, etc.)	1,608	505	1,667	477	579	135	481	111
Lime ... thousand short tons	87	1,030	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ... million cubic feet	4,098	1,160	2,869	815	2,808	859	[7] 4,000	[7] 1,320
Peat	2,900	23	(6)	(6)	13,606	117	12,875	138
Petroleum (crude) ... thousand 42-gallon barrels	2,748	12,091	2,677	12,662	1,763	7,457	[7] 1,981	[7] 8,399
Salt (common) ... thousand short tons	3,873	27,545	3,691	28,002	3,896	30,609	4,011	30,958
Sand and gravel ... do	27,815	28,722	25,640	26,480	24,730	27,541	27,943	31,415
Silver (recoverable content of ores, etc.) ... thousand troy ounces	84	76	64	58	67	60	52	47
Slate ... thousand short tons	64	944	59	961	(19)	(19)	(19)	(19)
Stone ... do	22,805	36,135	24,265	43,276	22,598	38,219	28,640	46,556
Zinc (recoverable content of ores, etc.)	59,111	16,196	64,659	15,001	53,014	10,815	43,464	9,997
Value of items that cannot be disclosed: Cement, abrasive garnet, iron oxide pigments (1956–58), talc, titanium concentrate, wollastonite, and values indicated by footnote 6		68,969		70,699		61,859		76,904
Total New York[9]		237,016		244,114		[5] 205,338		235,119

NORTH CAROLINA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones	[20] 454	$16	(13)	[21] $5	(13)	[21] $2	[22] 191	[22] $5
Beryllium concentrate ... gross weight	3	2	1	1	(11)	(12)		
Clays ... thousand short tons	2,663	2,027	[4] 2,392	[4] 1,407	[4] 2,046	[4] 1,187	[4] 2,524	[4] 1,522
Feldspar ... long tons	255,637	3,192	233,439	2,728	(6)	(6)	(6)	(6)
Gem stones	(13)	1	(13)	(12)	(13)	1	(13)	9
Gold (recoverable content of ores, etc.) ... troy ounces	882	31	1,373	48	876	31	965	34
Lead (recoverable content of ores, etc.)	10	3	9	3				
Mica:								
Scrap	47,125	1,065	53,452	1,173	50,897	1,041	47,736	1,212
Sheet ... pounds	770,903	2,135	577,607	1,575	521,701	1,722	505,623	1,755
Sand and gravel ... thousand short tons	7,581	6,264	6,829	5,724	7,044	5,880	8,580	7,426
Silver (recoverable content of ores, etc.) ... thousand troy ounces	1	1	12	11	15	14	16	15
Stone ... thousand short tons	[8] 8,352	[8] 11,472	[8] 9,455	[8] 12,839	12,385	19,132	12,859	20,302

Talc and pyrophyllite	125,487	529	120,905	558	126,158	614	127,296	647
Tungsten concentrate 60-percent WO_3 basis	2,732	[6]	1,828	[6]	[6]	[6]	[6]	[6]
Zinc (recoverable content of ores, etc.)			2	[12]				
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles and tube-mill liners, 1957–58, millstones 1959), asbestos (1957–59), clay (bentonite 1957, kaolin 1958–59), copper, iron ore (1959), lithium minerals, olivine, slate (1957), stone (crushed and dimension granite, crushed limestone, crushed miscellaneous, and dimension sandstone, 1956; dimension granite, crushed basalt, dimension and crushed marble, crushed limestone, and crushed sandstone 1957), and values indicated by footnote 6		14,135		11,498		10,267		7,862
Total North Carolina		40,873		37,570		39,891		40,789

NORTH DAKOTA

Clays [4] thousand short tons	52	$71	54	$67	54	$66	61	$79
Coal (lignite) do	2,815	6,578	2,561	5,947	2,314	5,409	2,413	5,426
Gem stones			[13]	[12]	[13]	1	[13]	1
Natural gas million cubic feet	11,725	950	15,450	1,468	17,325	1,672	[7] 16,500	[7] 1,700
Petroleum (crude) thousand 42-gallon barrels	13,495	39,136	13,259	41,501	14,259	42,634	[7] 17,960	[7] 50,288
Pumice thousand short tons	5	5	2	2	11	11		
Sand and gravel do	5,946	4,259	7,048	4,967	11,464	6,605	9,883	6,516
Stone do	83	87	29	52	23	35	48	84
Value of items that cannot be disclosed: Clays (bentonite), natural gas liquids, and values indicated by footnote 6		2,423		2,698		3,012		3,555
Total North Dakota		53,509		56,702		[5] 59,445		67,649

OHIO

Abrasive stones, grindstones and pulpstones	[6]	[6]	1,505	$132	852	$83	1,081	$101
Cement thousand 376-pound barrels	16,065	$49,794	16,238	52,184	15,700	53,043	18,994	63,935
Clays thousand short tons	6,703	17,675	6,136	16,073	5,220	13,082	5,478	15,346
Coal do	38,934	148,650	36,862	146,134	32,028	126,241	35,112	135,729
Lime do	2,995	40,805	2,763	38,383	2,411	32,471	3,190	45,121
Natural gas million cubic feet	25,368	6,088	30,384	7,201	31,786	6,802	[7] 31,900	[7] 7,800
Peat	15,509	174	5,478	102	5,660	104	5,813	73
Petroleum (crude) thousand 42-gallon barrels	4,785	15,025	5,478	17,694	6,260	18,091	[7] 5,566	[7] 15,974
Salt (common) thousand short tons	2,972	15,923	2,825	16,936	2,443	17,443	2,858	20,486
Sand and gravel do	30,200	36,146	30,596	37,503	29,624	36,619	38,604	45,139
Stone do	[8] 33,418	[8] 50,947	[8] 37,451	[8] 61,847	29,122	49,782	[8] 36,155	[8] 59,326
Value of items that cannot be disclosed: Calcium-magnesium chloride (1956), gem stones (1958–59), gypsum, natural gasoline (1956–58), stone (crushed sandstone 1956, dimension limestone 1957, and calcareous marl, 1957, 1959), and values indicated by footnote 6		5,394		2,453		1,905		2,029
Total Ohio [9]		375,488		383,000		344,856		395,901

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

OKLAHOMA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays[4] ....thousand short tons..	705	$701	641	$642	576	$579	966	$970
Coal ....do....	2,007	12,341	2,195	14,165	1,629	10,858	1,525	10,272
Helium ....thousand cubic feet..	----------	----------	----------	----------	----------	----------	98,749	1,619
Lead (recoverable content of ores, etc.)	12,350	3,878	7,183	2,054	3,692	864	601	138
Natural gas ....million cubic feet..	678,603	54,288	719,794	59,743	696,504	70,347	[7] 701,500	[7] 72,300
Natural-gas liquids:								
Natural gasoline and cycle products ....thousand gallons..	489,963	26,543	460,644	25,329	440,798	26,029	448,353	29,443
LP-gases ....do....	579,101	23,427	587,140	21,824	657,114	25,822	675,869	27,070
Petroleum (crude) ....thousand 42-gallon barrels..	215,862	600,096	214,661	650,423	200,699	594,069	[7] 196,487	[7] 573,742
Pumice ....thousand short tons..	(10)	3	(6)	(6)	(6)	(6)	(6)	(6)
Salt (common) ....do....	10	90	7	63	4	41	(6)	(6)
Sand and gravel ....do....	5,947	4,842	4,960	4,507	7,232	5,859	6,002	5,927
Stone ....do....	10,547	12,417	12,016	14,064	10,794	12,232	12,683	14,980
Tripoli	(6)	(6)	22,236	67	(6)	(6)	(6)	(6)
Zinc (recoverable content of ores, etc.)	27,515	7,539	14,951	3,469	5,267	1,074	1,049	241
Value of items that cannot be disclosed: Native asphalt, clay (bentonite), cement, gem stones (1959), gypsum, lime, manganese ore (1957), uranium ore (1956), and values indicated by footnote 6	----------	12,929	----------	14,573	----------	16,022	----------	18,156
Total Oklahoma[9]	----------	757,080	----------	809,004	----------	[8] 761,936	----------	751,907

OREGON

Mineral	1956		1957		1958		1959	
Chromite ....gross weight..	[23] 54,577	[23] $2,001	7,900	$675	4,133	(6)	----------	----------
Clays ....thousand short tons..	257	278	240	266	252	$293	294	$308
Copper (recoverable content of ores, etc.)	7	6	23	14	10	5	----------	----------
Gem stones	(13)	250	(13)	200	(13)	(6)	(13)	(6)
Gold (recoverable content of ores, etc.) ....troy ounces..	2,738	96	3,381	118	1,423	50	686	24
Iron ore (usable) ....thousand long tons..	1	(6)	(17)	(6)	----------	----------	----------	----------
Lead (recoverable content of ores, etc.)	5	2	5	1	1	(12)	----------	----------
Mercury ....76-pound flasks..	1,893	492	3,993	986	2,276	521	1,224	278
Nickel (content of ore and concentrate)	6,866	(6)	12,276	(6)	12,697	(6)	12,374	(6)
Pumice ....thousand short tons..	(6)	(6)	123	294	138	331	(6)	(6)
Sand and gravel ....do....	11,637	11,647	12,843	13,481	10,464	10,265	18,087	15,506
Silver (recoverable content of ores, etc.) ....thousand troy ounces..	14	12	16	14	3	2	(24)	(12)

Stone..........thousand short tons..	6,098	7,890	10,583	11,745	[5] 15,077	[5] 15,621	13,341	16,126
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, iron ore (pigment material, 1956–57, 1959), lime (1957–58), sodium carbonate (1956), tungsten concentrate (1956–57), uranium ore (1956–57), and values indicated by footnote 6..........	----------	12,689	----------	15,954	----------	19,311	----------	18,597
Total Oregon [9]..........	----------	34,021	----------	42,820	----------	[5] 45,190	----------	49,831
PENNSYLVANIA								
Cement..........thousand 376-pound barrels..	51,964	$162,387	44,680	$148,130	42,115	$142,399	43,356	$150,918
Clays..........thousand short tons..	[4] 4,413	[4] 23,782	4,074	22,012	[4] 3,318	[4] 17,051	3,466	17,196
Coal:								
Anthracite..........do....	28,900	236,785	25,338	227,754	21,171	187,898	20,649	172,320
Bituminous..........do....	90,287	479,437	85,365	492,539	67,771	373,812	65,347	345,332
Cobalt (content of concentrate)..........thousand pounds..	533	(6)	599	(6)	564	(6)	280	(6)
Gem stones..........	(13)	(6)	(13)	(6)	(13)	2	(13)	3
Lime..........thousand short tons..	1,443	18,282	1,298	18,406	1,003	[5] 14,161	1,263	18,261
Natural gas..........million cubic feet..	104,508	33,652	101,801	31,660	95,869	27,131	[7] 108,000	[7] 30,700
Natural-gas liquids:								
Natural-gasoline..........thousand gallons..	4,081	251	3,106	192	1,608	107	2,884	184
LP-gases..........do....	1,127	99	1,211	106	1,363	123	1,484	36
Peat..........	20,498	213	26,086	236	23,623	203	26,948	262
Petroleum (crude)..........thousand 42-gallon barrels..	8,230	35,718	8,179	38,687	6,472	26,535	[7] 6,156	[7] 25,855
Sand and gravel..........thousand short tons..	14,047	21,321	12,406	19,570	11,825	19,180	14,257	23,233
Slate..........do....	154	4,194	139	4,005	(19)	(19)	(19)	(19)
Stone..........do....	[8] 44,913	[8] 73,831	43,258	73,090	40,049	69,694	43,682	77,421
Tripoli..........	1,030	7	(6)	(6)	(6)	(6)	(6)	(6)
Zinc (recoverable content of ores, etc.) [18]..........	----------	----------	----------	----------	10,812	2,229	16,718	3,828
Value of items that cannot be disclosed: Clays (kaolin 1956, 1958), copper, gold, graphite (1959), iron ore (pigment material), mica, pyrites, pyrophyllite and soapstone, silver, stone (dimension basalt and shell 1956), and values indicated by footnote 6..........	----------	16,209	----------	[5] 16,613	----------	[5] 15,960	----------	15,812
Total Pennsylvania [9]..........	----------	1,088,481	----------	1,077,157	----------	[5] 882,040	----------	863,818
RHODE ISLAND								
Sand and gravel..........thousand short tons..	1,308	$1,263	1,058	$1,060	2,038	$1,883	1,740	$1,588
Stone..........do....	42	221	[8] 4	[8] 14	[8] 3	[8] 8	(6)	(6)
Value of items that cannot be disclosed: Nonmetals and values indicated by footnote 6..........	----------	143	----------	295	----------	358	----------	745
Total Rhode Island..........	----------	1,627	----------	1,369	----------	2,249	----------	2,333

See footnotes at end of table.

TABLE 5.—Mineral production [1] in the United States, by States—Continued

SOUTH CAROLINA

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays……thousand short tons	1,087	$5,450	937	$5,161	929	$5,157	1,160	$5,920
Mica (sheet)……pounds	5,400	14	2,278	12	1,144	8	251	3
Peat	------	------	------	------	4,865	(6)	4,194	(6)
Sand and gravel……thousand short tons	3,229	2,926	2,647	2,571	2,946	2,858	3,104	3,077
Stone……do	3,304	4,285	[8] 3,413	[8] 4,581	[8] 3,637	[8] 5,229	[8] 6,248	[8] 8,647
Zirconium concentrate	------	------	(6)	(6)	141	5	------	------
Value of items that cannot be disclosed: Barite, cement, feldspar (1959), gem stones (1958), kyanite, scrap mica, rare-earth metal concentrates (1956–58), staurolite (1957–58), stone (dimension granite 1956–57, crushed limestone 1956–59, crushed sandstone 1959, calcareous marl 1957–59), titanium (1956–58), vermiculite, and values indicated by footnote 6	------	9,277	------	10,491	------	9,586	------	13,640
Total South Carolina [15]	------	21,342	------	22,168	------	22,412	------	30,598
SOUTH DAKOTA								
Beryllium concentrate……gross weight	195	$95	268	$145	240	$129	156	$84
Clays [4]……thousand short tons	201	201	176	176	155	155	227	227
Coal (lignite)……do	25	90	21	79	20	78	22	88
Columbium-tantalum concentrate……pounds	237	(12)	2,311	6	4,294	10	------	------
Feldspar……long tons	45,226	289	41,316	267	23,229	145	30,825	196
Gem stones	(13)	10	(13)	15	(13)	16	(13)	20
Gold (recoverable content of ores, etc.)……troy ounces	568,523	19,898	568,130	19,885	570,830	19,979	577,730	20,221
Gypsum……thousand short tons	16	63	13	53	12	49	19	78
Iron ore (usable)……thousand long tons, gross weight	22	100	(17)	(6)	------	------	------	------
Mica:								
Scrap	1,268	31	1,626	43	1,003	24	158	5
Sheet……pounds	12,494	67	9,093	46	16,772	68	38,775	158
Petroleum (crude)……thousand 42-gallon barrels	32	(6)	54	(6)	58	(6)	[7] 119	(6)
Sand and gravel……thousand short tons	12,539	8,423	14,758	8,001	14,705	9,179	17,775	11,058
Silver (recoverable content of ores, etc.)……thousand troy ounces	136	123	135	122	153	138	124	113
Stone……thousand short tons	2,200	5,725	1,718	5,068	1,395	4,095	2,721	7,243
Uranium ore	35,302	475	69,800	760	35,489	530	45,734	606
Value of items that cannot be disclosed: Cement, clays (bentonite), lime, lithium minerals (1958–59), and values indicated by footnote 6	------	7,547	------	6,090	------	7,555	------	9,333
Total South Dakota [9]	------	42,281	------	39,997	------	41,534	------	48,485

TENNESSEE

Cement ... thousand 376-pound barrels	8,755	$25,435	7,415	$22,806	8,375	$26,408	9,153	$28,934
Clays ... thousand short tons	1,379	4,888	1,154	4,228	935	4,210	1,146	4,952
Coal ... do	8,848	35,609	7,955	31,147	6,785	25,969	5,913	23,581
Copper (recoverable content of ores, etc.)	10,449	8,882	9,790	5,894	9,109	4,791	11,490	7,055
Gem stones	---	---	---	---	(13)	1	(13)	(12)
Gold (recoverable content of ores, etc.) ... troy ounces	189	7	172	6	124	4	99	3
Iron ore (usable) ... thousand long tons, gross weight	(6)	(6)	(6)	(6)	(6)	(6)	21	111
Lead (recoverable content of ores, etc.)	5	1	---	---	---	---	---	---
Lime ... thousand short tons	125	1,436	94	1,134	(6)	(6)	(6)	(6)
Manganese ore (35 percent or more Mn) ... gross weight	17,821	1,417	12,938	1,007	5,935	452	7,586	589
Manganiferous ore (5 to 35 percent Mn) ... do	---	---	---	---	---	---	56	1
Natural gas ... million cubic feet	45	6	38	6	54	9	[7] 60	[7] 10
Petroleum (crude) ... thousand 42-gallon barrels	9	(6)	7	(6)	7	(6)	[7] 6	(6)
Phosphate rock ... thousand long tons	1,685	11,643	1,812	12,514	1,903	13,041	1,755	13,255
Sand and gravel ... thousand short tons	5,629	6,480	5,617	6,641	5,612	6,671	6,221	7,570
Silver (recoverable content of ores, etc.) ... thousand troy ounces	65	59	54	49	44	40	60	54
Stone ... thousand short tons	[8] 15,556	[8] 23,796	[8] 15,354	[8] 24,155	[8] 16,850	[8] 26,814	18,767	29,094
Zinc (recoverable content of ores, etc.)	46,023	12,610	58,063	13,470	59,130	12,062	89,932	20,684
Value of items that cannot be disclosed: Barite, fluorspar (1956–57), scrap mica (1956–59), pyrites, stone (crushed sandstone 1956–58, crushed granite 1957, dimension limestone 1958) and values indicated by footnote 6	---	8,772	---	8,029	---	[5] 6,884	---	7,392
Total Tennessee [9]	---	137,846	---	128,739	---	[5] 124,934	---	140,739

TEXAS

Cement ... thousand 376-pound barrels	25,966	$75,695	22,144	$68,541	25,875	$79,756	27,991	$88,067
Clays [4] ... thousand short tons	3,146	4,765	2,992	4,934	3,720	5,424	3,870	5,703
Gem stones	(13)	115	(13)	100	(13)	100	(13)	100
Gypsum ... thousand short tons	1,157	3,623	1,043	3,343	1,240	4,120	1,351	4,770
Helium ... thousand cubic feet	145,830	2,364	204,286	3,353	294,452	4,807	238,113	3,918
Lime ... thousand short tons	592	6,938	796	7,489	691	7,146	809	8,530
Natural gas ... million cubic feet	4,999,889	434,990	5,156,215	500,153	5,178,073	517,807	[7] 5,600,300	[7] 560,400
Natural-gas liquids:								
Natural gasoline and cycle products ... thousand gallons	2,964,609	216,378	2,944,381	201,423	2,871,589	204,501	2,790,155	209,238
LP-gases ... do	3,731,047	144,745	3,831,664	147,618	3,786,575	151,896	4,353,368	181,148
Petroleum (crude) ... thousand 42-gallon barrels	1,107,808	3,131,225	1,073,867	3,338,119	940,166	2,872,389	[7] 983,840	[7] 2,931,843
Salt (common) ... thousand short tons	3,963	14,370	4,612	17,104	3,843	15,115	4,519	17,498
Sand and gravel ... do	29,336	27,213	23,685	23,427	32,871	30,808	35,295	34,726
Stone ... do	32,773	36,350	31,248	36,153	36,076	40,912	42,172	47,787
Sulfur (Frasch-process) ... thousand long tons	3,437	91,026	2,879	70,226	2,616	61,621	2,970	68,998
Talc and soapstone	41,332	244	47,780	199	60,827	168	60,945	283
Value of items that cannot be disclosed: Abrasive stones (1956–57, 1959), native asphalt, bromine, clay (fuller's earth), coal (lignite), feldspar (1957–59), graphite, iron ore, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, pumice (1956–58), sodium sulfate, and uranium ore	---	62,354	---	71,510	---	[5] 46,891	---	48,544
Total Texas [9]	---	4,241,258	---	4,484,538	---	[5] 4,033,311	---	4,201,203

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

UTAH

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Asphalt and related bitumens, native: Gilsonite	(6)	(6)	207,704	$4,259	317,280	$4,864	379,362	$9,385
Carbon dioxide, natural ... thousand cubic feet	(6)	(6)	(6)	(6)	90,207	6	69,625	5
Clays [4] ... thousand short tons	227	$492	164	473	157	488	185	484
Coal ... do	6,522	34,436	6,858	40,263	5,328	30,340	4,545	27,982
Copper (recoverable content of ores, etc.)	250,604	213,013	237,857	143,190	189,184	99,511	144,715	88,855
Fluorspar	10,581	265	11,087	387	16,109	564	(6)	(6)
Gem stones	(13)	10	(13)	12	(13)	40	(13)	134
Gold (recoverable content of ores, etc.) ... troy ounces	416,031	14,561	378,438	13,245	307,824	10,774	239,517	8,383
Iron ore (usable) ... thousand long tons, gross weight	4,002	27,508	4,156	30,383	3,514	25,202	2,842	19,979
Lead (recoverable content of ores, etc.)	49,555	15,560	44,471	12,719	40,355	9,443	36,630	8,425
Lime ... thousand short tons	55	830	53	821	80	1,513	90	1,773
Manganese ore (35 percent or more Mn) ... gross weight	------	------	142	12	1,043	84	1,511	124
Mica (sheet) ... pounds	------	------	------	------	12	(12)	------	------
Natural gas ... million cubic feet	17,268	2,435	16,824	2,473	19,247	2,829	[7] 31,000	[7] 4,600
Natural gasoline ... thousand gallons	(6)	(6)	(6)	(6)	240	15	(6)	(6)
Perlite	2,271	9	(6)	(6)	(6)	(6)	(6)	(6)
Petroleum (crude) ... thousand 42-gallon barrels	2,466	5,302	4,367	9,913	24,811	74,185	[7] 40,109	[7] 114,712
Phosphate rock ... thousand long tons	125	772	114	756	(6)	(6)	(6)	(6)
Pumice ... thousand short tons	45	330	36	148	41	84	39	81
Salt (common) ... do	184	1,471	221	2,013	184	2,275	209	2,453
Sand and gravel ... do	5,836	4,476	26,958	15,485	25,304	14,379	8,843	6,436
Silver (recoverable content of ores, etc.) ... thousand troy ounces	6,572	5,948	6,199	5,610	5,278	4,777	3,734	3,380
Stone ... thousand short tons	2,322	3,298	7,854	8,540	13,126	13,949	3,338	4,048
Tungsten ore and concentrate ... 60-percent WO_3 basis	11	41	------	------	------	------	------	------
Uranium ore	926,273	25,214	1,075,759	32,501	1,239,767	38,583	1,210,654	37,310
Vanadium ... thousand pounds	1,099	(6)	1,017	(6)	752	(6)	1,072	(6)
Zinc (recoverable content of ores, etc.)	42,374	11,610	40,846	9,476	44,982	9,176	35,223	8,101
Value of items that cannot be disclosed: Barite (1959), cement, clay (kaolin), gypsum, molybdenum, LP-gases (1959), potassium salts, pyrites (1959), and values indicated by footnote 6	------	33,352	------	27,651	------	[5] 25,214	------	27,396
Total Utah [15]	------	399,759	------	359,335	------	[5] 367,232	------	373,017

VERMONT

Copper (recoverable content of ores, etc.)	3,403	$2,893	3,405	$2,050	475	$250		
Gem stones					(13)	1	(13)	$1
Gold (recoverable content of ores, etc.) troy ounces	(6)	(6)	62	2				
Pyrites thousand long tons	23	107	10	56				
Sand and gravel thousand short tons	1,910	905	2,216	1,051	1,882	1,316	[3] 2,320	[3] 1,590
Silver (recoverable content of ores, etc.) thousand troy ounces	(6)	(6)	37	33	5	5		
Slate thousand short tons	162	3,772	(6)	3,269	(19)	(19)	(19)	(19)
Stone do	621	11,622	557	11,404	808	15,789	944	17,372
Value of items that cannot be disclosed: Asbestos, clays, lime, talc, and values indicated by footnote 6		3,915		4,058		4,106		4,420
Total Vermont [15]		23,131		21,893		21,443		23,359

VIRGINIA

Beryllium concentrate gross weight	1	(12)						
Clays thousand short tons	1,000	$1,033	893	$986	1,153	$1,143	1,346	$1,396
Coal do	28,063	138,127	29,506	153,959	26,826	130,319	29,769	139,224
Gem stones	(13)	(6)			(13)	3	(13)	4
Lead (recoverable content of ores, etc.)	3,035	953	3,143	899	2,934	687	2,770	637
Lime thousand short tons	512	5,926	510	6,029	471	5,533	765	8,168
Manganese ore (35 percent or more Mn) gross weight	20,231	1,902	12,655	1,058	8,128	647	6,232	499
Manganiferous ore (5 to 35 percent Mn) do	(6)	(6)			56	1	(6)	(6)
Marl, calcareous (except for cement)	10,522	12	(16)	(16)	(16)	(16)	(16)	(16)
Mica, sheet pounds	396	6	529	6	147	2	108	1
Natural gas million cubic feet	2,926	810	2,465	661	2,521	681	[7] 1,440	[7] 400
Petroleum (crude) thousand 42-gallon barrels	4	(6)	5	(6)	4	(6)	[7] 6	(6)
Sand and gravel thousand short tons	7,783	9,420	7,047	9,877	7,158	10,834	8,452	12,369
Silver (recoverable content of ores, etc.) thousand troy ounces	2	2	(6)	(6)	2	2	1	1
Slate thousand short tons	32	1,035	(6)	1,003	(19)	(19)	(19)	(19)
Stone do	14,082	23,076	[8] 14,244	[8] 21,158	15,413	27,504	17,787	31,447
Zinc (recoverable content of ores, etc.) [23]	19,196	5,181	23,080	5,277	18,472	3,808	20,334	4,662
Value of items that cannot be disclosed: Aplite, cement, feldspar, gypsum, iron oxide pigments (1955–57), kyanite, mica (scrap 1955), pyrites, salt, stone (dimension miscellaneous, dimension sandstone, and calcareous marl (1957), talc and soapstone, titanium concentrate, and values indicated by footnote 6		24,931		29,746		[5] 25,471		28,848
Total Virginia [9]		208,806		227,108		[5] 203,277		222,304

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

WASHINGTON

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stone: Pebbles (grinding)	25	[12]	25	[12]	18	[12]	[6]	[12]
Chromite ... gross weight	30	$3	------	------	17	$2	------	------
Clays ... thousand short tons	320	440	298	$488	[4] 196	[4] 183	[4] 180	[4] $171
Coal ... do	473	3,432	360	2,761	252	1,968	242	1,841
Copper (recoverable content of ores, etc.)	2,926	2,487	1,700	1,023	52	27	49	30
Gem stones	[13]	75	[13]	75	[13]	75	[13]	[6]
Gold (recoverable content of ores, etc.) ... troy ounces	70,669	2,473	[6]	[6]	[6]	[6]	[6]	[6]
Gypsum ... thousand short tons	[6]	[6]	6	[6]	[6]	[6]	[6]	[6]
Iron ore (usable) ... thousand long tons	2	[6]	4	[6]	4	[6]	4	5
Lead (recoverable content of ores, etc.)	11,657	3,660	12,734	3,642	9,020	2,111	10,310	2,371
Manganese ore (35 percent or more Mn) ... gross weight	------	------	------	------	------	------	83	[6]
Peat	37,043	129	39,364	153	34,642	116	32,884	124
Petroleum (crude) ... thousand 42-gallon barrels	------	------	5	[6]	4	[6]	[7] 1	[6]
Pumice ... thousand short tons	5	15	[6]	[6]	[6]	[6]	9	112
Sand and gravel ... do	16,842	15,037	20,415	17,510	24,389	20,086	21,360	18,576
Silver (recoverable content of ores, etc.) ... thousand troy ounces	448	406	[6]	[6]	[6]	[6]	[6]	[6]
Stone ... thousand short tons	8,057	11,660	8,897	11,645	7,837	9,991	12,278	13,587
Talc and soapstone	[6]	[6]	4,065	25	4,000	21	4,073	23
Tungsten concentrate ... 60-percent WO_3 basis	2	[6]	[11]	[6]	------	------	------	------
Uranium ore	[6]	[6]	[6]	[6]	[6]	[6]	152,336	[6]
Zinc (recoverable content of ores, etc.)	25,609	7,017	24,000	5,568	18,797	3,835	17,111	3,936
Value of items that cannot be disclosed: Barite (1957–59), carbon dioxide, cement, fire clay (1958–59), diatomite, epsomite (1956–57), lime (1956–57), magnesite, mercury (1957–58), olivine, strontium minerals, and values indicated by footnote 6	------	17,736	------	18,950	------	24,128	------	25,054
Total Washington[9]	------	61,723	------	60,471	------	60,896	------	63,894

WEST VIRGINIA

Clays……thousand short tons	770	$2,449	708	$2,691	510	$1,960	596	$2,492
Coal……do	155,890	824,043	156,842	875,587	119,468	635,201	119,692	621,003
Gem stones	----------	----------	----------	----------	----------	----------	(13)	1
Marl, calcareous	1,685	1	(16)	(16)	(16)	(16)	(16)	(16)
Natural gas……million cubic feet	204,717	48,518	202,440	48,181	204,581	50,734	[7] 215,000	[7] 53,500
Natural-gas liquids:								
Natural gasoline……thousand gallons	35,728	2,594	30,435	2,185	27,917	5,643	29,242	1,808
LP-gases……do	240,989	12,031	235,881	6,543	235,524	12,806	308,316	15,534
Petroleum (crude)……thousand 42-gallon barrels	2,179	8,411	2,215	9,436	2,186	7,629	[7] 2,177	[7] 7,837
Salt (common)……thousand short tons	681	3,453	648	2,642	627	2,784	811	3,305
Sand and gravel……do	5,110	10,711	5,354	9,893	5,253	11,729	4,854	10,513
Stone……do	6,579	10,765	6,989	11,934	[8] 5,599	[8] 9,990	[8] 5,923	[8] 10,482
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, cement, lime, manganese ore (1957), stone (crushed sandstone 1958, dimension sandstone and calcareous marl 1959)	----------	14,515	----------	14,938	----------	[5] 13,067	----------	13,318
Total West Virginia [9]	----------	934,999	----------	981,654	----------	[5] 749,747	----------	737,886

WISCONSIN

Abrasive stones	1,093	$31	1,790	$43	858	$26	770	$27
Clays……thousand short tons	163	172	131	136	154	167	178	192
Iron ore (usable)……thousand long tons, gross weight	1,488	(6)	1,576	(6)	867	(6)	701	(6)
Lead (recoverable content of ores, etc.)	2,582	811	1,900	543	800	187	745	171
Lime……thousand short tons	(6)	(6)	(6)	(6)	141	2,193	(6)	(6)
Marl, calcareous (except for cement)	11,074	6	(16)	(16)	(16)	(16)	(16)	(16)
Peat	----------	----------	400	(6)	(6)	(6)	7,500	(6)
Sand and gravel……thousand short tons	27,715	19,097	29,394	18,694	39,383	25,845	41,999	27,535
Stone……do	11,126	20,402	12,434	22,455	13,722	23,334	13,522	23,782
Zinc (recoverable content of ores, etc.)	23,890	6,546	21,575	5,006	12,140	2,477	11,635	2,676
Value of items that cannot be disclosed: Cement, gem stones (1957–59), and values indicated by footnote 6	----------	19,451	----------	22,590	----------	18,083	----------	18,541
Total Wisconsin [9]	----------	65,860	----------	68,644	----------	71,334	----------	71,959

See footnotes at end of table.

TABLE 5.—Mineral production[1] in the United States, by States—Continued

WYOMING

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate.....gross weight..	(6)	(6)	5	$3	17	$9	1	(12)
Clays.....thousand short tons..	1,086	$11,864	[4] 1,069	[4] 11,973	[4] 1,075	[4] 9,968	[4] 764	[4] $9,449
Coal.....do....	2,553	9,920	2,117	7,777	1,629	5,820	1,977	6,669
Copper (recoverable content of ores, etc.).....	3	3	4	2	(11)	(12)	---	---
Feldspar.....long tons..	1,201	8	(6)	(6)	(6)	(6)	---	---
Gem stones.....	(13)	75	(13)	55	(13)	52	(13)	76
Gold (recoverable content of ores, etc.).....troy ounces..	762	27	573	20	117	4	---	---
Gypsum.....thousand short tons..	11	46	(6)	(6)	6	19	9	31
Iron ore (usable).....thousand long tons, gross weight..	650	(6)	736	(6)	557	(6)	503	2,923
Natural gas.....million cubic feet..	84,398	7,258	117,256	10,201	121,682	10,221	[7] 123,500	[7] 10,700
Natural-gas liquids:								
Natural gasoline.....thousand gallons..	48,859	3,160	47,709	2,866	49,451	3,052	64,586	4,003
LP-gases.....do....	49,838	2,337	57,805	2,566	54,496	2,614	90,314	3,951
Petroleum (crude).....thousand 42-gallon barrels..	104,830	255,785	109,584	291,493	115,572	301,643	[7] 125,968	[7] 314,920
Phosphate rock.....thousand long tons..	119	721	18	121	124	937	(6)	(6)
Pumice.....thousand short tons..	46	38	49	41	45	40	94	77
Rare-earth metals concentrates.....	---	---	2	5	---	---	---	---
Sand and gravel.....thousand short tons..	3,904	2,935	2,425	1,905	5,333	4,760	4,692	3,982
Sodium carbonate (natural).....	337,851	8,345	(6)	(6)	(6)	(6)	(6)	(6)
Stone.....thousand short tons..	1,333	2,076	1,291	2,266	1,099	1,472	1,317	1,791
Tungsten ore and concentrate.....60-percent WO_3 basis..	2	7	---	---	---	---	---	---
Uranium ore.....	156,509	2,765	274,699	4,669	651,790	13,286	864,582	17,610
Value of items that cannot be disclosed: Cement, fire clay (1957–59, miscellaneous clay 1959), sheet mica (1959), silver (1956–58), sodium sulfate, vanadium (1956–58), and values indicated by footnote 6.....	---	7,824	---	17,527	---	16,760	---	15,970
Total Wyoming[9].....	---	314,380	---	352,532	---	369,938	---	391,621

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[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes certain cement, value for which is included with "Items that cannot be disclosed."

[3] Final figure. Supersedes preliminary figure given in commodity chapter.

[4] Excludes certain clays, value for which is included with "Items that cannot be disclosed."

[5] Revised figure.

[6] Figure withheld to avoid disclosing individual company confidential data.

[7] Preliminary figure.

[8] Excludes certain stone, value included with "Items that cannot be disclosed."

[9] Total adjusted to eliminate duplicating the value of clays and stone.

[10] Less than 1,000 short tons.

[11] Less than 1 ton.

[12] Less than $1,000.

[13] Weight not recorded.

[14] Total weight of columbite-tantalite plus $(Cb\text{-}Ta)_2O_5$ content of euxenite.

[15] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and/or lime.

[16] Beginning with 1957 calcareous marl included with stone.

[17] Less than 1,000 long tons.

[18] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.

[19] Beginning with 1958 slate included with stone.

[20] Grinding pebbles and tube-mill liners, weight of millstones not recorded.

[21] Millstones only.

[22] Grinding pebbles and tube-mill liners.

[23] Includes 45,710 short tons of concentrate produced in 1955 and 1956 from low-grade ore and concentrate stockpiled near Coquille, Oreg. during World War II.

[24] Less than 1,000 troy ounces.

[25] Excludes quantity consumed by American Chrome Co.

TABLE 6.—Mineral production[1] in the Canal Zone and islands administered by the United States[2]

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
American Samoa:								
Stone ......thousand short tons..	2	$6	34	$37	30	$59	178	$219
Canal Zone:								
Sand and gravel ......thousand short tons..	40	48	------	------	41	34	14	21
Stone (crushed) ......do....	177	230	59	99	140	237	223	270
Total Canal Zone	------	278	------	99	------	271	------	291
Canton:								
Sand and gravel ......thousand short tons..	------	------	------	------	------	------	(3)	(4)
Stone (crushed) ......do....	2	5	------	------	------	------	(3)	1
Guam:								
Sand and gravel ......thousand short tons..	19	24	1	1	9	23	28	20
Stone ......do....	341	311	1,034	1,132	684	751	568	1,109
Total Guam:	------	335	------	1,133	------	774	------	1,129
Midway: Stone (crushed) ......thousand short tons..	203	304	3,875	6,700	175	476	------	------
Virgin Islands: Stone (crushed) ......do....	12	32	11	31	25	81	14	51
Wake: Stone (crushed) ......do....	22	22	5	6	10	37	32	34

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Production data for Canton and Wake furnished by the U.S. Department of Commerce, Civil Aeronautics Administration; Midway and Johnston, by the U.S. Department of the Navy; Guam by the Government of Guam; American Samoa, by the Government of American Samoa.

[3] Less than 1,000 short tons.

[4] Less than $1,000.

TABLE 7.—Mineral production[1] in the Commonwealth of Puerto Rico

Mineral	1956		1957		1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement........thousand 376-pound barrels..	4,255	$14,065	5,552	$17,232	4,748	$15,175	5,392	$16,982
Clays........thousand short tons..	143	129	159	140	165	83	167	83
Lime........do....	(2)	(2)	(2)	(2)	(2)	(2)	10	321
Salt (common)........do....	10	101	10	104	1	14	3	38
Sand and gravel........do....	183	192	497	754	476	763	530	888
Stone........do....	2,076	2,556	2,452	3,505	1,986	2,768	2,063	2,878
Value of items that cannot be disclosed: Other nonmetals and values indicated by footnote 2........	....	195	....	180	....	272	....	....
Total Puerto Rico[3]........	....	16,395	....	20,265	....	17,689	....	19,700

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Total adjusted to eliminate duplicating value of stone.

TABLE 8.—Principal minerals imported for consumption in the United States

(Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census)

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Metal	255,322	$117,297	239,571	$111,259
Scrap	9,922	2,969	10,919	3,299
Plates, sheets, bars, etc	[1] 27,946	[1] 20,184	50,638	34,876
Antimony:				
Ore (antimony content)	3,427	643	6,466	1,236
Needle or liquated	136	58	177	79
Metal	4,282	1,871	4,422	2,039
Oxide	1,634	643	2,056	825
Arsenic: White	9,524	720	19,386	1,342
Bauxite:				
Crude ... thousand long tons	[1][2] 7,915	[1] 70,107	[2] 8,107	73,203
Calcined:				
When imported for manufacture of firebrick ... long tons	29,414	715	[3] 108,457	[3] 1,750
Other ... do	100	2	200	4
Beryllium ore	4,599	1,547	8,038	2,345
Bismuth (general imports) ... pounds	637,309	1,233	457,163	825
Boron carbide ... do	47,368	133	81,459	144
Cadmium:				
Metal ... thousand pounds	1,002	1,312	1,638	1,744
Flue dust (cadmium content) ... do	1,218	661	1,544	584
Calcium:				
Metal ... pounds	15,694	24	7,425	8
Chloride	[1] 1,234	[1] 46	1,756	66
Chromate:				
Ore and concentrates (Cr_2O_3 content)	544,447	28,206	665,463	31,853
Ferrochrome (chromium content)	15,965	7,818	64,066	29,750
Metal	[1] 2,326	[1] 4,716	2,865	5,179
Cobalt:				
Metal ... thousand pounds	[1] 14,538	[1] 28,664	20,087	35,926
Oxide (gross weight) ... do	837	1,116	1,561	1,856
Salts and compounds (gross weight) ... do	234	145	278	134
Columbium ore ... pounds	2,555,942	2,346	3,395,816	2,652
Copper (copper content):				
Ore	5,926	2,357	113	34
Concentrates	84,871	37,968	9,299	5,505
Regulus, black, coarse	4,925	2,172	7,113	4,260
Unrefined, black, blister	138,633	66,320	203	126
Refined in ingots, etc	124,629	61,139	237,304	146,478
Old and scrap	5,849	2,676	2,984	1,634
Old brass and clippings	4,201	1,852	1,257	698
Ferroalloys: Ferrosilicon (silicon content)	2,398	905	5,584	1,728
Gold:				
Ore and base bullion ... troy ounces	1,099,484	38,457	444,416	15,522
Bullion ... do	7,020,242	251,298	8,040,528	288,855
Iron ore:				
Ore ... thousand long tons	[1] 27,544	[1] 231,617	35,613	312,367
Pyrites ... long tons	2,721	9	10,157	48
Iron and steel:				
Pig iron	209,743	[1] 12,026	701,775	35,593
Iron and steel products (major):				
Semimanufactures	[1] 788,922	66,930	2,263,470	230,950
Manufactures	[1] 1,030,765	[1] 152,972	2,349,400	332,982
Scrap	295,859	10,069	267,839	10,493
Tin-plate scrap	36,763	1,000	41,609	1,098
Lead:				
Ore, flue dust, matte (lead content)	[1] 237,625	[1] 50,772	136,696	26,921
Base bullion (lead content)	416	136	34	19
Pigs and bars (lead content)	351,759	71,404	262,632	54,667
Reclaimed, scrap, etc. (lead content)	8,619	1,441	7,897	1,304
Sheets, pipe, and shot	2,625	596	3,608	850
Babbitt metal and solder (lead content)	2,049	4,677	3,751	16,820
Type metal and antimonial lead (lead content)	4,525	1,190	5,020	1,204
Manufactures	1,272	446	1,398	586
Magnesium:				
Metallic and scrap	537	280	593	303
Alloys (magnesium content)	9	38	26	155
Sheets, tubing, ribbons, wire, and other forms (magnesium content)	16	97	26	121

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Manganese:				
Ore (35 percent or more manganese) (manganese content)	837,100	$76,256	887,681	$74,648
Ferromanganese (manganese content)	49,521	11,046	70,232	14,067
Mercury:				
Compounds.....pounds	9,125	29	40,522	118
Metal.....76-pound flasks	[1] 30,196	[1] 5,922	30,141	5,992
Minor metals: Selenium and salts.....pounds	204,311	1,380	273,929	1,761
Molybdenum: Ore and concentrates (molybdenum content).....pounds	1,344	6	-----	-----
Nickel:				
Ore and matte	4,574	1,765	4,071	1,612
Pigs, ingots, shot, cathodes	62,793	87,311	82,924	110,754
Scrap	271	254	619	731
Oxide	29,622	35,106	[2] 30,062	[2] 33,816
Platinum group:				
Unrefined metals:				
Ore and concentrates.....troy ounces	-----	-----	503	27
Grains and nuggets, including crude, dust, and residues.....do	21,635	1,341	77,763	5,447
Sponge and scrap.....do	[2] 13,167	[2] 823	[2] 5,666	[2] 420
Osmiridium.....do	1,450	85	2,121	76
Refined metal:				
Platinum.....do	[2] 247,763	[2] 15,363	[2] 260,524	[2] 17,241
Palladium.....do	360,077	5,211	610,740	9,374
Iridium.....do	1,156	78	7,772	402
Osmium.....do	145	8	1,223	65
Rhodium.....do	17,280	1,803	29,342	3,369
Ruthenium.....do	7,758	259	14,679	492
Radium:				
Radium salts.....milligrams	38,419	538	32,967	518
Radioactive substitutes	(4)	908	(4)	1,145
Rare earths: Ferrocerium and other cerium alloy.....pounds	11,544	46	16,070	59
Silver:				
Ore and base bullion.....thousand troy ounces	134,650	102,286	39,759	34,522
Bullion.....do	31,316	27,807	29,329	26,558
Tantalum: Ore.....pounds	1,035,588	1,838	652,839	1,166
Tin:				
Ore (tin content).....long tons	5,440	11,244	10,773	23,282
Blocks, pigs, grains, etc.....do	41,149	84,624	43,493	96,666
Dross, skimmings, scrap, residues, and tin alloys, n.s.p.f.....long tons	3,208	5,771	3,434	6,658
Tinfoil, powder, flitters, etc	(4)	610	(4)	1,008
Titanium:				
Ilmenite	348,144	6,766	371,687	7,991
Rutile	36,563	4,513	23,228	2,943
Metal.....pounds	4,146,896	6,287	3,126,293	3,564
Ferrotitanium.....do	201,333	73	252,436	70
Compounds and mixtures.....do	1,417,522	285	5,722,512	1,088
Tungsten: (tungsten content)				
Ore and concentrates.....thousand pounds	6,542	11,960	5,435	4,235
Metal.....pounds	101,363	230	196,053	425
Ferrotungsten.....thousand pounds	159	154	533	526
Other.....pounds	83	1	93,963	105
Zinc:				
Ores (zinc content)	[1] 537,699	[1] 51,121	436,009	38,568
Blocks, pigs, and slabs	185,693	[1] 35,511	164,462	33,996
Sheets	901	285	951	311
Old, dross, and skimmings	972	108	1,138	142
Dust	96	14	44	6
Manufactures	(4)	390	(4)	812
Zirconium: Ore, including zirconium sand	19,225	467	54,878	1,517

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS				
Abrasives: Diamonds (industrial) carats	[1] 10,070,305	[1] $39,213	13,076,172	$62,703
Asbestos	644,331	58,314	713,047	65,006
Barite:				
Crude and ground	527,571	3,754	641,241	4,881
Witherite	2,240	108	2,552	113
Chemicals	4,171	416	6,045	551
Bromine pounds	11,925	38	24,000	9
Cement 376-pound barrels	3,390,086	9,682	5,264,996	13,773
Clays:				
Raw	[1] [2] 126,692	2,835	172,986	3,193
Manufactured	35,030	65	3,494	95
Cryolite	24,186	2,332	22,102	1,994
Feldspar: Crude long tons	73	5	45	5
Fluorspar	392,164	9,777	555,750	13,368
Gem stones:				
Diamonds carats	[1] 1,848,230	[1] 140,631	2,528,419	180,665
Emeralds do	38,848	1,100	88,875	2,450
Other	(4)	24,212	(4)	29,421
Graphite	27,067	1,203	37,048	1,527
Gypsum:				
Crude, ground, calcined	[1] 4,047,786	[1] 6,896	6,135,636	11,917
Manufactures	(4)	967	(4)	1,287
Iodine, crude thousand pounds	1,561	1,329	1,466	1,083
Kyanite	1,965	95	5,633	252
Lime:				
Hydrated	1,000	21	530	9
Other	18,822	318	26,374	442
Dead-burned dolomite	5,686	322	8,474	498
Magnesium:				
Magnesite	[1] 81,684	[1] 5,210	155,634	9,871
Compounds	12,477	505	15,849	562
Mica:				
Uncut sheet and punch pounds	2,181,056	5,092	3,224,698	7,318
Scrap	4,064	48	4,644	57
Manufactures	[1] 5,053	8,800	5,042	7,443
Mineral-earth pigments: Iron oxide pigments:				
Natural	2,485	123	3,161	160
Synthetic	5,933	889	7,776	1,144
Ocher, crude and refined	217	10	213	13
Siennas, crude and refined	555	49	1,399	95
Umber, crude and refined	2,278	73	2,078	68
Vandyke brown	204	15	202	14
Nitrogen compounds (major), including urea	1,349,585	59,840	[2] 1,472,408	65,265
Phosphate, crude long tons	108,182	2,944	139,891	3,421
Phosphatic fertilizers do	24,562	1,711	57,230	2,543
Pigments and salts:				
Lead pigments and salts	8,557	1,770	13,233	2,694
Zinc pigments and salts	13,206	2,520	19,147	3,678
Potash	[5] 366,161	[5] 14,736	[5] 432,114	[5] 17,578
Pumice:				
Crude or unmanufactured	38,613	274	21,721	152
Wholly or partly manufactured	1,873	48	3,988	92
Manufactures, n.s.p.f.	(4)	15	(4)	20
Quartz crystal (Brazilian pebble) pounds	473,000	356	679,836	784
Salt	611,043	3,368	1,024,629	5,438
Sand and gravel:				
Glass sand	6,516	224	101	91
Other sand	317,860	486	348,331	464
Gravel	7,619	7	102,878	93
Sodium sulfate thousand short tons	97	1,968	122	2,580
Stone, including slate	(4)	8,312	(4)	11,064
Strontium: Mineral	[1] 6,686	141	8,139	225
Sulfur and pyrites:				
Sulfur:				
Ore long tons	18,906	445	11,593	255
Other forms, n.e.s. do	571,781	13,106	630,895	13,646
Pyrites do	343,060	1,194	280,638	868
Talc: Unmanufactured	22,890	785	25,351	861

See footnotes at end of table.

TABLE 8.—Principal minerals imported for consumption in the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
COAL, PETROLEUM, AND RELATED PRODUCTS				
Carbon black:				
Acetylene black ... pounds	7,154,224	$1,287	7,246,932	$1,335
Gas black and carbon black ... do	125,958	22	346,771	69
Coal:				
Anthracite	4,363	34	2,633	22
Bituminous, slack, culm, and lignite	306,940	[1] 2,546	374,713	2,433
Briquets	184	2	185	3
Coke	121,517	1,571	123,255	1,441
Peat:				
Fertilizer grade	258.824	11,433	277,006	13,003
Poultry and stable grade	10,272	602	9,713	577
Petroleum:				
Crude ... thousand barrels	[1] 383,707	[1] 939,709	381,946	866,551
Gasoline [6] ... do	[1] 29,729	[1] 111,263	21,168	73,035
Kerosine ... do	34	148	125	536
Distillate oil [7] ... do	[1] 14,715	[1] 46,317	14,801	51,502
Residual oil [8] ... do	[1] 195,925	[1] 452,067	224,010	455,574
Unfinished oils ... do	20,510	56,316	23,135	65,823
Asphalt ... do	7,501	18,935	6,982	17,043
Miscellaneous ... do	14	222	25	333

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[1] Revised figure.
[2] Adjusted by Bureau of Mines.
[3] Believed by Bureau of Mines to contain some crude bauxite.
[4] Weight not recorded.
[5] Data covers some quantities furnished by Potash Institute; values adjusted by Bureau of Mines.
[6] Includes naphtha but excludes benzol, 1958—1,060,597 barrels ($10,928,459); 1959—1,365,152 barrels ($13,783,172).
[7] Includes quantities imported free of duty for supplies of vessels and aircraft.
[8] Includes quantities imported free for manufacture in bond and export and for supplies of vessels and aircraft.

TABLE 9.—Principal minerals and products exported from the United States

(Compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census)

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS				
Aluminum:				
Ingots, slabs, crude	52,711	$24,220	121,081	$53,518
Scrap	18,906	5,595	32,388	10,485
Plates, sheets, bars, etc	9,183	10,240	9,015	9,977
Castings and forgings	1,633	3,022	1,216	2,842
Antimony: Metals and alloys, crude	39	23	9	4
Arsenic: Calcium arsenate ... pounds	1,274,000	81	122,920	12
Bauxite, including bauxite concentrates ... long tons	11,868	968	[1] 17,403	[1] 1,825
Aluminum sulfate	9,864	423	14,487	573
Other aluminum compounds	32,803	4,438	32,049	4,286
Beryllium ... pounds	57,636	247	164,460	1,530
Bismuth: Metals and alloys ... do	316,318	389	179,744	261
Cadmium ... thousand pounds	580	771	900	1,024
Calcium chloride	37,632	1,325	39,929	1,377

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Chrome:				
Ore and concentrates:				
Exports	717	$49	[2] 72,645	[2] $3,084
Reexports	52,303	2,158	24,467	976
Chromic acid	486	281	596	349
Ferrochrome	1,920	1,012	6,127	2,096
Cobalt ... pounds	1,757,600	1,102	694,641	543
Columbium metals, alloys, and other forms ... do	54,711	42	15,414	21
Copper:				
Ores, concentrates, composition metal, and unrefined copper (copper content)	11,475	5,865	2,982	1,808
Refined copper and semimanufactures	428,015	[3] 229,535	196,012	128,577
Other copper manufactures	2,302	1,567	4,352	3,280
Copper sulfate or blue vitriol	7,248	1,176	2,672	675
Copper base alloys	36,565	26,906	37,607	30,002
Ferroalloys:				
Ferrosilicon ... pounds	4,353,279	392	21,115,496	981
Ferrophosphorus ... do	89,006,784	1,468	99,806,945	1,799
Gold:				
Ore and base bullion ... troy ounces	26,929	945	20,498	715
Bullion, refined ... do	859,042	30,077	29,104	1,218
Iron ore ... thousand long tons	[3] 3,573	[3] 34,898	2,967	33,831
Iron and steel:				
Pig iron	103,348	6,725	10,444	549
Iron and steel products (major):				
Semimanufactures	[3] 1,693,877	[3] 300,570	1,069,848	213,297
Manufactured steel mill products	[3] 1,531,261	[3] 406,467	886,371	238,757
Advanced products	(4)	156,072	(4)	165,871
Iron and steel scrap: Ferrous scrap, including rerolling materials	[3] [5] 2,927,860	[3] [5] 95,412	4,849,076	165,464
Lead:				
Ore, matte, base bullion (lead content)	1,012	252	224	54
Pigs, bars, anodes	1,359	467	2,756	751
Scrap	1,015	237	1,141	291
Magnesium:				
Metal and alloys and semifabricated forms, n.e.c	1,041	1,280	2,377	2,028
Powder	11	16	12	32
Manganese:				
Ore and concentrates	4,833	700	5,702	819
Ferromanganese	1,406	464	947	388
Mercury:				
Exports ... 76-pound flasks	320	95	640	92
Reexports ... do	934	199	553	119
Molybdenum:				
Ore and concentrates (molybdenum content) ... pounds	[3] 11,966,204	[3] 14,965	18,852,279	24,778
Metals and alloys, crude and scrap ... do	14,151	5	15,172	22
Wire ... do	11,346	215	12,395	250
Semifabricated forms, n.e.c ... do	20,878	63	8,921	91
Powder ... do	4,841	16	11,314	36
Ferromolybdenum ... do	226,246	245	248,012	280
Nickel:				
Ore	10	1	----------	----------
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc	[3] 12,820	[3] 16,043	11,818	11,967
Catalysts	485	1,023	597	1,162
Nickel-chrome electric resistance wire	154	678	139	598
Semifabricated forms, n.e.c	563	2,491	519	2,314
Platinum:				
Ore, concentrates, metal and alloys in ingots, bars, sheets, anodes, and other forms, including scrap ... troy ounces	35,075	1,233	18,560	1,147
Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys including scrap) ... troy ounces	12,293	379	12,845	390
Platinum group manufactures, except jewelry	(4)	2,103	(4)	2,306
Radium metal (radium content) ... milligrams	[3] 140	[3] 5	2,207	40

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
METALS—continued				
Rare earths:				
Cerium ores, metals, and alloys...pounds	29,998	$24	27,500	$17
Lighter flints...do	7,720	47	13,343	50
Silver:				
Ore and base bullion...thousand troy ounces	1,640	1,456	103	93
Bullion, refined...do	1,093	1,000	9,077	8,381
Tantalum:				
Ore, metal, and other forms...pounds	20,076	302	16,478	242
Powder...do	5,773	212	1,988	76
Tin:				
Ingots, pigs, bars, etc.:				
Exports...long tons	917	1,336	943	1,890
Reexports...do	424	899	428	970
Tin scrap and other tin bearing material except tinplate scrap...do	2,291	992	7,713	1,231
Tin cans finished or unfinished...do	35,849	18,322	36,320	19,027
Titanium:				
Ores and concentrates	1,246	172	4,656	290
Sponge (including iodide titanium) and scrap	97	172	496	543
Intermediate mill shapes	192	1,772	380	2,770
Mill products, n.e.c	144	3,456	119	2,391
Ferrotitanium	323	138	321	146
Dioxide and pigments	37,016	11,347	36,282	10,558
Tungsten: Ore and concentrates:				
Exports	22	[r]17	1	5
Reexports	162	207	98	119
Vanadium ore and concentrates (vanadium content)...pounds	1,261,083	2,625	2,480,343	4,668
Zinc:				
Ores and concentrates (zinc content)	---	---	1	(6)
Slabs, pigs, or blocks	[3]2,073	[3]704	11,629	2,673
Sheets, plates, strips, or other forms, n.e.c	3,818	2,637	3,529	2,708
Scrap (zinc content)	5,344	364	11,332	1,053
Dust	519	170	521	182
Semifabricated forms, n.e.c	1,168	542	1,071	612
Zirconium:				
Ores and concentrates	1,994	336	1,511	263
Metals and alloys and other forms...pounds	100,556	757	89,819	661
NONMETALS				
Abrasives:				
Grindstones	280	45	401	52
Diamond dust and powder...carats	123,194	378	172,787	440
Diamond grinding wheels...do	203,095	1,294	249,950	1,518
Other natural and artificial metallic abrasives and products	(4)	[3]20,752	(4)	21,088
Asbestos: Unmanufactured:				
Exports	2,937	407	4,317	763
Reexports	89	17	144	30
Boron: Boric acid, borates, crude and refined...pounds	471,167,767	18,292	507,347,292	21,047
Bromine, bromides, and bromates...do	10,071,033	3,129	9,171,539	2,594
Cement...376-pound barrels	641,159	2,975	277,267	1,595
Clay:				
Kaolin or china clay	66,419	1,602	74,734	2,206
Fire clay	125,923	1,880	137,389	2,468
Other clays	257,436	8,646	276,715	8,800
Cryolite	164	46	176	53
Fluorspar	3,374	191	1,144	69
Graphite:				
Amorphous	767	97	1,003	126
Crystalline flake, lump or chip	164	52	169	61
Natural, n.e.c	235	43	196	36
Gypsum:				
Crude, crushed, or calcined...thousand short tons	29	921	14	641
Manufactures, n.e.c	(4)	1,544	(4)	655
Iodine, iodide, iodates...thousand pounds	199	314	175	249
Kyanite and allied minerals	2,493	127	2,734	167
Lime	45,844	[3]1,047	52,780	1,000

See footnotes at end of table.

TABLE 9.—Principal minerals and products exported from the United States—Continued

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
NONMETALS—continued				
Mica:				
Unmanufactured..........pounds..	1, 030, 540	$91	1, 072, 894	$126
Manufactured:				
Ground or pulverized..........do....	8, 198, 367	431	8, 915, 109	459
Other..........do....	254, 198	696	216, 040	653
Mineral-earth pigments: Iron oxide, natural and manufactured..........	3, 914	1, 065	4, 337	1, 040
Nitrogen compounds (major)..........	704, 492	38, 938	747, 024	37, 415
Phosphate rock..........long tons..	2, 818, 073	25, 234	3, 239, 722	28, 602
Phosphatic fertilizers..........do....	514, 227	23, 388	413, 867	19, 539
Pigments and salts (lead and zinc):				
Lead pigments..........	3, 446	1, 095	3, 178	1, 054
Zinc pigments..........	3, 156	912	3, 054	864
Lead salts..........	1, 050	412	699	276
Potash:				
Fertilizer..........	496, 805	16, 478	560, 001	16, 502
Chemical..........	9, 871	1, 799	11, 658	1, 994
Quartz crystal (raw)..........	(4)	285	(4)	166
Radioactive isotopes, etc..........curie..	156, 191	1, 534	112, 204	1, 283
Salt:				
Crude and refined..........	363, 009	2, 273	424, 348	2, 660
Shipments to noncontiguous Territories..........	12, 790	1, 026	13, 652	1, 031
Sodium and sodium compounds:				
Sodium sulfate..........	20, 193	786	21, 527	805
Sodium carbonate..........thousand short tons..	104	4, 279	153	5, 644
Stone:				
Limestone, crushed, ground, broken..........	767, 757	1, 390	1, 085, 553	1, 999
Marble and other building and monumental cubic feet..	349, 366	1, 236	425, 194	1, 262
Stone, crushed, ground, broken..........	173, 340	3, 697	157, 911	3, 388
Manufactures of stone..........	(4)	432	(4)	643
Sulfur:				
Crude..........long tons..	[3] 1, 577, 919	[3] 39, 507	1, 611, 908	39, 967
Crushed, ground, flowers of..........do....	[3] 24, 207	[3] 1, 932	23, 699	2, 033
Talc:				
Crude and ground..........	58, 647	1, 358	58, 751	1, 532
Manufactures, n.e.c..........	212	93	197	175
Powders-talcum (face and compact)..........	(4)	1, 341	(4)	1, 276
COAL, PETROLEUM, AND RELATED PRODUCTS				
Carbon black..........thousand pounds..	440, 542	39, 748	513, 143	45, 798
Coal:				
Anthracite..........	2, 279, 859	35, 762	1, 787, 558	28, 931
Bituminous..........	[3] 50, 293, 382	[3] 490, 028	37, 226, 766	349, 273
Briquets..........	54, 961	899	33, 458	495
Coke..........	392, 817	7, 127	460, 222	8, 674
Petroleum:				
Crude..........thousand barrels..	4, 345	14, 748	2, 524	6, 990
Gasoline [7]..........do....	[3] 20, 374	[3] 142, 646	15, 518	108, 766
Kerosine..........do....	1, 140	5, 369	934	4, 926
Distillate oil..........do....	17, 115	63, 638	12, 681	46, 153
Residual oil..........do....	[3] 22, 782	[3] 54, 104	21, 319	45, 685
Lubricating oil..........do....	[3] 12, 464	185, 807	13, 536	181, 931
Asphalt..........do....	1, 083	6, 013	813	4, 623
Liquefied petroleum gases..........do....	2, 854	8, 423	2, 251	6, 791
Wax..........do....	905	19, 861	1, 031	22, 202
Coke..........do....	4, 406	18, 026	4, 680	19, 608
Petroleum..........do....	256	6, 084	260	6, 361
Miscellaneous..........do....	518	13, 655	563	14, 656

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[1] Adjusted by Bureau of Mines.
[2] Believed to be mostly foreign exports.
[3] Revised figure.
[4] Weight not recorded.
[5] Excludes circles strip and scroll shear butts, due to this exclusion, plus revisions, the 1958 data will differ from that shown in 1958 Minerals Yearbook, t. 23, p. 615.
[6] Less than $1,000.
[7] Includes naptha, but excludes benzol: 1958—273,428 barrels ($3,562,974), 1959—173,935 barrels ($2,340,389).

TABLE 10.—Comparison of world and United States[1] production of principal metals and minerals, 1958–59

[Compiled by Augusta W. Jann and Berenice B. Mitchell]

Mineral	1958			1959		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Fuels:						
Coal:						
Bituminous	1,836,437	408,019	22	1,902,134	409,248	22
Lignite	678,265	2,427	(2)	687,771	2,780	(2)
Pennsylvania anthracite	175,100	21,171	12	186,000	20,649	11
Coke (excluding breeze):						
Gashouse [3]	51,308	(4)	(4)	49,960	(4)	(4)
Oven and beehive	281,459	53,604	19	289,795	55,863	19
Fuel briquets and packaged fuel	117,610	1,071	(2)	114,650	900	(2)
Natural gas (marketable) million cubic feet	(5)	11,030,298	(5)	(5)	12,046,115	(5)
Peat	65,510	328	(2)	70,600	419	(2)
Petroleum (crude) thousand barrels	6,607,856	2,449,016	37	7,127,310	2,574,590	36
Nonmetallic minerals:						
Asbestos	2,060	44	2	2,270	45	2
Barite	2,600	486	19	3,000	867	29
Cement thousand barrels	1,543,394	326,352	21	1,720,526	355,734	21
Cordundum	11	----------	--------	8	----------	--------
Diamonds thousand carats	28,400	----------	--------	26,800	----------	--------
Diatomite	1,090	450	41	1,060	450	42
Feldspar [6] thousand long tons	1,050	470	45	1,150	548	48
Fluorspar	1,830	320	17	1,855	185	10
Graphite	350	(4)	(4)	410	(4)	(4)
Gypsum	38,740	9,600	25	42,320	10,900	26
Magnesite	6,000	493	8	6,150	594	10
Mica (including scrap) thousand pounds	315,000	187,355	59	340,000	200,588	59
Nitrogen, agricultural [6 7]	8,700	2,360	27	9,700	2,675	28
Phosphate rock thousand long tons	34,770	14,879	43	36,530	15,869	43
Potash (K_2O equivalent)	8,800	2,148	24	9,400	2,383	25
Pumice	9,200	1,973	21	10,300	2,276	22
Pyrites thousand long tons	18,300	974	5	16,700	1,057	6
Salt	82,200	21,911	27	88,900	25,163	28
Strontium [6]	12	----------	--------	14	(4)	(4)
Sulfur, elemental thousand long tons	8,405	5,286	63	9,075	5,326	59
Talc, pyrophyllite, and soapstone	2,000	718	36	2,400	795	33
Vermiculite [6]	246	191	78	260	207	80
Metals, mine basis:						
Antimony (content of ore and concentrate) [6] short tons	44,000	705	2	52,000	678	1
Arsenic [6]	39	12	31	47	5	11
Bauxite thousand long tons	20,900	1,311	6	22,500	1,700	8
Beryllium concentrates short tons	7,400	463	6	7,300	328	4
Bismuth thousand pounds	4,600	(4)	(4)	5,200	(4)	(4)
Cadmium thousand pounds	19,900	9,673	49	19,700	8,602	44
Chromite	4,165	144	3	4,255	105	2
Cobalt (contained) short tons	14,600	2,012	14	17,700	1,165	6
Columbium-tantalum concentrates thousand pounds	4,990	428	9	6,170	189	3
Copper (content of ore and concentrate)	3,780	979	26	4,020	825	21
Gold thousand fine ounces	40,600	1,759	4	42,800	1,635	4
Iron ore thousand long tons	398,439	67,709	17	429,018	60,276	14
Lead (content of ore and concentrate)	2,560	267	10	2,530	256	10
Manganese ore (35 percent or more Mn)	13,663	327	2	14,042	229	2
Mercury thousand 76-pound flasks	251	38	15	232	31	13
Molybdenum (content of ore and concentrate) thousand pounds	57,700	41,069	71	70,300	50,956	72
Nickel (content of ore and concentrate)	249	12	5	312	12	4
Platinum groups (Pt, Pd, etc.) thousand troy ounces	890	14	2	1,000	15	2
Silver thousand fine ounces	238,500	36,800	15	216,800	23,000	11
Tin (content of ore and concentrate) thousand long tons	153	----------	--------	161	(4)	(4)
Titanium concentrates:						
Ilmenite	1,722	563	33	1,909	635	33
Rutile	103	7	7	105	9	9
Tungsten concentrate (60 percent WO_3) short tons	55,500	3,788	7	56,850	3,649	6

See footnotes at end of table.

TABLE 10.—Comparison of world and United States[1] production of principal metals and minerals, 1958–59—Continued

Mineral	1958			1959		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Metals, mine basis—Continued						
Vanadium (content of ore and concentrate)[6] short tons	4,231	3,030	72	5,325	3,719	70
Zinc (content of ore and concentrate)	3,330	412	12	3,390	425	13
Metals, smelter basis:						
Aluminum	3,880	1,566	40	4,510	1,953	43
Copper	3,950	1,069	27	4,170	842	20
Iron, pig (incl. ferroalloys)	216,700	58,867	27	246,300	62,135	25
Lead	2,500	469	19	2,420	341	14
Magnesium	104	30	29	104	31	30
Selenium thousand pounds	1,533	727	47	1,866	799	43
Steel ingots and castings	298,600	85,255	29	336,100	93,446	28
Tellurium thousand pounds	224	171	76	357	196	55
Tin thousand long tons	158	[8] 5	3	154	[8] 11	7
Uranium oxide (U_3O_8)[6]	36	13	36	43	16	37
Zinc	2,990	781	26	3,140	799	25

[1] Including noncontiguous territories.
[2] Less than 1 percent.
[3] Includes low- and medium-temperature and gashouse coke.
[4] Bureau of Mines not at liberty to publish U.S. figure separately.
[5] Data not available.
[6] World total exclusive of U.S.S.R.
[7] Year ended June 30 of year stated (United Nations).
[8] U.S. imports of tin concentrates (tin content).

Employment and Injuries in the Mineral Industries

By John C. Machisak[1]

◆

THIS CHAPTER of the Minerals Yearbook (Volume III) contains overall employment and injury experience for coal mines—bituminous, lignite, and anthracite; coke, petroleum and natural gas; and peat and slag plants; metal and nonmetal mines; sand and gravel operations; stone quarries; metallurgical plants, including metal mills and smelters; and nonmetal mills for 1959. Volume I of the yearbook contains injury experience and employment data in the metal, nonmetal, sand and gravel, slag, and quarrying industries, and the milling operations and related plants. Volume II contains the injury experience and employment data in the fuel industries—coal, coke, petroleum and natural gas, and peat.

Surveys conducted by the Bureau of Mines were the source of injury and employment data used to compile the tables and furnish information for the accompanying text. Response to the surveys was voluntary except that for coal mines. The Coal Mine Safety Act requires operators of coal mines to furnish the information requested.

Preliminary figures for the mineral industries indicate an improvement in the safety record for 1959, with a 5-percent decrease in the combined (fatal and nonfatal) injury-frequency rate per million man-hours of worktime. The number of men working in 1959, compared with the preceding year, declined 7 percent; however, 4 days more were indicated as active. The average employee worked 1,988 hours in 1959, an increase of 2 percent over the 1,955 hours worked in 1958.

Three major disasters (a single accident in which 5 or more men are killed) occurred in the mineral industries in 1959. A mine fire killed 6 men in an iron mine in Michigan; a gas explosion in a bituminous-coal mine in Tennessee caused the death of 9 men; and an inrush of water in a Pennsylvania anthracite mine resulted in the death of 12 men.

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[1] Chief, Branch of Accident Analysis, Division of Accident Prevention and Health.

UNIVERSITY OF ILLINOIS

TABLE 1.—Salient statistics of employment and injury experienced in the industries in the United States, by industry groups

	1955	1956	1957	1958	1959 [1]
Average number of men working daily: [2]					
Coal mines	[3] 260,089	260,285	254,725	224,890	197,394
Coke plants	20,681	20,473	20,264	16,186	16,645
Petroleum and natural gas	617,274	585,486	617,596	584,708	559,244
Peat [4]	------	------	139	464	467
Metal mines	65,143	68,273	68,457	59,608	53,553
Nonmetal mines (except stone quarries) [5]	14,504	15,595	17,921	17,820	16,255
Sand and gravel operations [6]	------	------	31,531	51,122	43,597
Stone quarries	78,238	80,093	84,126	88,448	78,056
Slag (iron blast-furnace) [7]	------	------	------	1,882	1,789
Metallurgical plants	57,741	65,681	65,212	52,109	43,927
Nonmetal mills [8]	8,723	17,585	27,081	32,401	34,330
Total [9]	1,122,393	1,113,471	1,187,052	1,129,638	1,045,257
Average number of active mine days:					
Coal mines	206	212	204	183	192
Coke plants	352	346	355	351	328
Petroleum and natural gas	264	264	262	260	265
Peat [4]	------	------	209	171	178
Metal mines	263	264	259	229	213
Nonmetal mines (except stone quarries) [5]	264	268	262	239	246
Sand and gravel operations [6]	------	------	221	211	216
Stone quarries	274	272	266	264	273
Slag (iron blast-furnace) [7]	------	------	------	248	254
Metallurgical plants	314	327	322	302	273
Nonmetal mills [8]	283	288	274	272	269
Total [9]	256	258	254	244	248
Man-days worked, in thousands: [9]					
Coal mines	[3] 53,591	55,286	52,077	41,121	37,874
Coke plants	7,279	7,082	7,187	5,683	5,467
Petroleum and natural gas	162,877	154,444	161,716	151,965	148,143
Peat [4]	------	------	29	79	83
Metal mines	17,113	18,017	17,751	13,665	11,412
Nonmetal mines (except stone quarries) [5]	3,836	4,178	4,691	4,258	4,006
Sand and gravel operations [6]	------	------	6,954	10,763	9,403
Stone quarries	21,470	21,777	22,410	23,353	21,344
Slag (iron blast-furnace) [7]	------	------	------	467	455
Metallurgical plants	18,150	21,470	21,003	15,733	12,012
Nonmetal mills [8]	2,467	5,056	7,415	8,809	9,246
Total [9]	286,783	287,311	301,232	275,895	259,444
Man-hours worked, in thousands: [9]					
Coal mines	[3] 419,379	433,662	408,207	322,229	297,461
Coke plants	58,164	56,557	57,337	45,486	43,626
Petroleum and natural gas	1,303,014	1,235,555	1,293,725	1,215,722	1,185,146
Peat [4]	------	------	231	704	738
Metal mines	136,950	144,407	142,181	109,523	91,643
Nonmetal mines (except stone quarries) [5]	31,093	33,963	37,877	34,648	32,736
Sand and gravel operations [6]	------	------	59,764	92,456	80,770
Stone quarries	175,775	178,281	183,394	186,821	170,750
Slag (iron blast-furnace) [7]	------	------	------	3,776	3,681
Metallurgical plants	145,841	171,578	167,489	125,773	96,217
Nonmetal mills [8]	19,843	40,675	59,765	71,161	75,128
Total [9]	2,290,058	2,294,678	2,409,970	2,208,298	2,077,897
Number of injuries:					
Fatal:					
Coal mines	420	448	478	358	292
Coke plants	9	10	12	5	3
Petroleum and natural gas	135	147	121	116	120
Peat [4]	------	------	------	------	1
Metal mines	79	89	71	70	56
Nonmetal mines (except stone quarries) [5]	19	17	9	15	10
Sand and gravel operations [6]	------	------	35	25	20
Stone quarries	53	50	53	45	48
Slag (iron blast-furnace) [7]	------	------	------	1	1
Metallurgical plants	11	20	21	12	10
Nonmetal mills [8]	3	7	10	9	10
Total [9]	729	788	810	656	571

See footnotes at end of table.

TABLE 1.—Salient statistics of employment and injury experienced in the mineral industries of the United States, by industry groups—Continued

	1955	1956	1957	1958	1959 [1]
Number of injuries:					
Nonfatal:					
Coal mines	[3] 18,885	19,816	18,792	14,160	12,823
Coke plants	325	301	244	210	222
Petroleum and natural gas	13,038	11,372	11,426	11,588	10,543
Peat [4]	------	------	5	12	14
Metal mines	5,837	5,475	4,554	3,499	2,852
Nonmetal mines (except stone quarries) [5]	1,156	1,036	1,112	955	940
Sand and gravel operations [6]	------	------	1,763	1,698	1,622
Stone quarries	3,811	3,754	4,210	4,572	3,997
Slag (iron blast-furnace) [7]	------	------	------	43	43
Metallurgical plants	2,694	2,543	2,280	1,698	926
Nonmetal mills [8]	451	1,157	1,512	1,490	1,821
Total [9]	46,197	45,454	45,898	39,925	35,803
Injury rates per million man-hours:					
Fatal:					
Coal mines	1.00	1.03	1.17	1.11	0.98
Coke plants	.15	.18	.21	.11	.07
Petroleum and natural gas	.10	.12	.09	.10	.10
Peat [4]	------	------	------	------	1.36
Metal mines	.58	.62	.50	.64	.61
Nonmetal mines (except stone quarries) [5]	.61	.50	.24	.43	.31
Sand and gravel operations [6]	------	------	.59	.27	.25
Stone quarries	.30	.28	.29	.24	.28
Slag (iron blast-furnace) [7]	------	------	------	.26	.27
Metallurgical plants	.08	.12	.13	.10	.10
Nonmetal mills [8]	.15	.17	.17	.13	.13
Total [9]	.32	.34	.34	.30	.27
Nonfatal:					
Coal mines	45.03	45.69	46.04	43.94	43.11
Coke plants	5.59	5.32	4.26	4.62	5.09
Petroleum and natural gas	10.01	9.20	8.83	9.53	8.90
Peat [4]	------	------	21.68	17.05	18.97
Metal mines	42.62	37.91	32.03	31.95	31.15
Nonmetal mines (except stone quarries) [5]	37.18	30.50	29.36	27.56	28.71
Sand and gravel operations [6]	------	------	29.50	18.37	20.08
Stone quarries	21.68	21.06	22.96	24.47	23.41
Slag (iron blast-furnace) [7]	------	------	------	11.39	11.68
Metallurgical plants	18.47	14.82	13.61	13.50	9.62
Nonmetal mills [8]	22.73	28.44	25.30	20.94	24.24
Total [9]	20.17	19.81	19.05	18.08	17.23

[1] Preliminary figures, except anthracite, coke, petroleum, peat, and slag.
[2] Men at work each day mine was active.
[3] Revised figure.
[4] Peat canvass included beginning 1957.
[5] Clay mines included beginning 1955.
[6] Sand and gravel canvass included beginning 1957.
[7] Slag (iron blast-furnace) canvass included beginning 1958.
[8] Nonmetal mills shown beginning 1955; clay included 1956.
[9] Revised figures, petroleum and natural gas and slag (iron blast-furnace) included.
Note: Man-days and man-hours worked have been rounded to nearest thousand and will not necessarily add to published totals.

Work Stoppages.—According to the U.S. Department of Labor, Bureau of Labor Statistics, 210 work stoppages occurred in certain mineral industries during 1959 and resulted in approximately 6,264,000 man-days of work lost. Most of these work stoppages occurred in the bituminous-coal mining industry (146), with a loss of 1,560,000 man-days. The anthracite mining industry, however, had only one work stoppage with slightly over 1,000 man-days lost. Iron mines with 2,120,000 days lost and copper mines with 1,800,000 man-days lost accounted for eight and nine work stoppages, respectively. The remaining 46 work stoppages occurred in the petroleum, crushed and broken stone, cement, lead-zinc, chemical and fertilizer mineral

TABLE 2.—Work stoppages in certain mineral industries in the United States [1]

Industry and year	Work stoppages: Number	Work stoppages: Man-days lost (thousands)
Coal mining:		
Anthracite:		
1955	17	9.5
1956	18	56.3
1957	3	2.6
1958	8	2.1
1959	1	1.2
Bituminous:		
1955	292	273.0
1956	266	377.0
1957	161	136.0
1958	136	102.0
1959	146	[2] 1,560.0
Coke and byproducts:		
Coke only:		
1955	1	(3)
1956	3	56.0
1957	5	25.1
1958	(4)	(4)
1959	(4)	(4)
Petroleum refining:		
1955	8	43.4
1956	9	90.4
1957	9	200.0
1958	8	124.0
1959	13	543.0
Metal mining:		
Iron:		
1955	6	[5] 27.0
1956	5	679.0
1957	4	18.6
1958	1	9.7
1959	8	2,120.0
Copper:		
1955	3	479.0
1956	3	7.0
1957	3	31.5
1958	2	22.0
1959	9	1,800.0
Lead-zinc:		
1955	6	[6] 123.0
1956	3	[6] [2] 94.1
1957	5	7.1
1958	----------	----------
1959	5	28.0
Gold-silver:		
1955	1	1.2
1956	1	25.3
1957	1	[7] 1.5
1958	----------	----------
1959	----------	----------
Bauxite and other aluminum ores:		
1955	----------	----------
1956	1	5.3
1957	----------	----------
1958	----------	----------
1959	----------	----------
Ferroalloy metal ores:		
1955	1	(3)
1956	----------	----------
1957	----------	----------
1958	2	84.2
1959	1	(3)
Metal mining services:		
1955	----------	----------
1956	2	(3)
1957	----------	----------
1958	----------	----------
1959	1	(3)
Metal mining—Con.		
Miscellaneous metal ores:	2	7.0
1955	1	(3)
1956	1	2.0
1957	2	1.5
1958	2	2.0
1959		
Mining and quarrying of nonmetallic minerals (except fuels):		
Dimension stone:	4	5.8
1955	2	25.1
1956	3	18.0
1957	2	14.3
1958	----------	----------
1959		
Crushed and broken stone:	7	12.2
1955	15	45.2
1956	4	8.2
1957	7	5.7
1958	8	76.9
1959		
Sand and gravel:	4	1.6
1955	3	2.0
1956	2	(3)
1957	2	25.2
1958	3	[2] 11.1
1959		
Clay, ceramic and refractory minerals:	----------	----------
1955	----------	----------
1956	1	(3)
1957	(3)	(3)
1958	2	1.2
1959		
Chemical and fertilizer mineral mining:	1	143.0
1955	1	1.5
1956	4	4.6
1957	5	32.5
1958	3	45.5
1959		
Nonmetallic minerals (except fuels) services:	----------	----------
1955	----------	----------
1956	1	1.1
1957	----------	----------
1958	----------	----------
1959		
Miscellaneous nonmetallic minerals (except fuels):	2	2.0
1955	2	(3)
1956	----------	----------
1957	1	2.5
1958	----------	----------
1959		
Cement, hydraulic:	4	4.5
1955	14	68.4
1956	6	436.6
1957	6	38.6
1958	8	74.8
1959		

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[1] Compiled by U.S. Department of Labor, Bureau of Labor Statistics, revised data.
[2] Includes idleness from stoppages which began in previous year.
[3] Less than 1,000 man-days.
[4] Data not available.
[5] Includes some quarries.
[6] Includes some silver.
[7] Includes some lead, copper, zinc, and silver.

mining, sand and gravel, miscellaneous metal ore, clay, and ferroalloy ore and metal-mining-services industries. Ferroalloy ores and metal-mining services each had one work stoppage and less than 1,000 man-days lost. The remaining 44 work stoppages—petroleum with 13, crushed and broken stone with 8, cement 8, lead-zinc 5, chemical and fertilizer mineral mining 3, sand and gravel 3, miscellaneous metal ores 2, and clays 2—accounted for the 783,000 man-days lost.

NATIONAL SAFETY COMPETITION

The National Safety Competitions, sponsored and conducted annually by the Bureau of Mines, have stimulated great interest in safety among the Nation's mineral-extractive industries and encouraged the development of more effective accident-prevention programs by according national recognition to operations achieving outstanding safety records. Of the 1,085 operations participating in the 1959 competitions, 495 (45.6 percent) were injury free—the greatest number in any single year. These 495 injury-free operations worked approximately 37 million man-hours (24 percent) of the total exposure to occupational hazards.

Of the five competitions conducted by the Bureau of Mines, two are sponsored by the Bureau. They are the National Safety and National Sand and Gravel Competitions. In these two contests, 385 operations (45.6 percent) finished the competition year free of disabling work injuries. These 385 operations accounted for 27,404,902 man-hours (21 percent) of the total man-hours worked (130,108,375) by all participating operations in these two Bureau-conducted competitions.

In addition, the Bureau of Mines conducted three other annual competitions, cosponsored by national associations connected with the mineral industries. These associations were the National Crushed Stone, National Lime, and National Slag. During the 1959 contest, 240 plants participated in the association-sponsored contests, of which 110 (45.8 percent) attained disabling injury-free records during an aggregate worktime of almost 10 million man-hours. These injury-free man-hours accounted for 40 percent of the total man-hours worked by all plants participating in these competitions.

Trophy awards for the best safety records in each of the six groups in the 1959 National Safety Competion were made to the following:

Anthracite Underground Mines.—The Stockton mine of Jeddo-Highland Coal Co., Stockton, Pa.

Bituminous-Coal Underground Mines.—The Harwick mine of the Duquesne Light Co., Harwick, Pa.

Metal Underground Mines.—Wauseca mine of the Hanna Mining Co., (The M. A. Hanna Co.), Iron River, Mich.

Nonmetal Underground Mines.—Akron mine of the Bestwall Gypsum Company, Akron, N.Y.

Open-Pit Mines.—Rouchleau mine of the Oliver Iron Mining Division, United States Steel Corp., Virginia, Minn.

Quarries.—Port Inland quarry of the Inland Lime and Stone Co., Division of Inland Steel Co., Gulliver, Mich.

TABLE 3.—Employment and injury experience in the mineral industries

	Men working	Man-hours worked	Number of injuries		Injury rate per million man-hours	
			Fatal	Nonfatal	Fatal	Nonfatal
1931	784, 347	1, 288, 135, 808	1, 707	94, 021	1. 33	72. 99
1932	671, 343	962, 924, 915	1, 368	66, 028	1. 42	68. 57
1933	677, 722	1, 058, 245, 650	1, 242	70, 158	1. 17	66. 30
1934	739, 817	1, 167, 723, 543	1, 429	79, 211	1. 22	67. 83
1935	783, 139	1, 215, 316, 764	1, 495	80, 070	1. 23	65. 88
1936	824, 514	1, 426, 233, 543	1, 686	90, 608	1. 18	63. 53
1937	859, 951	1, 482, 241, 908	1, 759	94, 466	1. 19	63. 73
1938	774, 894	1, 144, 137, 296	1, 369	69, 940	1. 20	61. 13
1939	788, 925	1, 251, 169, 210	1, 334	73, 253	1. 07	58. 55
1940	801, 926	1, 385, 128, 234	1, 716	80, 856	1. 24	58. 37
1941	835, 095	1, 541, 335, 277	1, 621	87, 911	1. 05	57. 04
1942 [1]	1, 120, 450	2, 319, 213, 897	1, 970	100, 861	. 85	43. 49
1943	1, 144, 831	2, 555, 619, 729	1, 953	101, 164	. 76	39. 58
1944	1, 086, 103	2, 573, 452, 816	1, 751	98, 066	. 68	38. 11
1945	1, 033, 035	2, 363, 783, 323	1, 414	87, 578	. 60	37. 05
1946	1, 108, 517	2, 275, 960, 528	1, 336	86, 291	. 59	37. 91
1947	1, 179, 835	2, 469, 256, 565	1, 556	91, 311	. 63	36. 98
1948	1, 242, 241	2, 530, 418, 226	1, 383	86, 295	. 55	34. 10
1949	1, 240, 330	2, 256, 418, 166	898	65, 909	. 40	29. 21
1950	1, 237, 649	2, 340, 954, 733	952	66, 729	. 41	28. 51
1951	1, 223, 639	2, 418, 090, 394	1, 122	67, 285	. 46	27. 83
1952	1, 230, 692	2, 383, 608, 034	927	61, 296	. 39	25. 72
1953	1, 193, 182	2, 357, 970, 591	817	53, 992	. 35	22. 90
1954	1, 096, 423	2, 138, 687, 112	671	43, 130	. 31	20. 17
1955	1, 122, 393	2, 290, 057, 680	729	46, 197	. 32	20. 17
1956	1, 113, 471	2, 294, 678, 414	788	45, 454	. 34	19. 81
1957	1, 187, 052	2, 409, 969, 589	810	45, 898	. 34	19. 05
1958 [2]	1, 129, 638	2, 208, 298, 487	656	39, 925	. 30	18. 08
1959 [3]	1, 045, 257	2, 077, 897, 290	571	35, 803	. 27	17. 23

[1] Revised figures including oil and gas beginning with 1942.
[2] Slag included beginning with 1958.
[3] Preliminary figures.

The Mineral Industry of Alabama

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Alabama.

By Avery H. Reed, Jr.[1] and Walter B. Jones[2]

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RECORD production of portland cement, crushed limestone, marble, lime, and clays highlighted the mineral industry of Alabama in 1959. Among the States, Alabama ranked second in production of bauxite, and third in output of iron ore, scrap mica, and native asphalt.

Alabama's mineral industry was dominated by the mining and processing of coal and iron ore, which accounted for 51 percent of the total value of production in 1958 and 1959. Other important industries were cement manufacturing, petroleum, and stone quarrying. Leading companies were Tennessee Coal & Iron Division of United States Steel Corp. (coal, iron ore, limestone, lime, and magnesium compounds), Southern Cement Co. Division of American-Marietta Co. (cement, lime, limestone, and miscellaneous clay), Woodward Iron Co. (coal and iron ore), Alabama Power Co. (coal), and Ideal Cement Co. (cement, lime, and miscellaneous clay).

The total value of mineral production rose 6 percent over 1958 but was 5 percent below 1957, the record year. The increase was distributed among all major industries.

Employment and Injuries.—Total employment in the mineral industries increased 8 percent over 1958. Employment at coal mines increased 10 percent, at quarries and mills 8 percent, and at coke ovens 5 percent.

Injury-frequency rate was unchanged from 1958; however, decreased rates were recorded for coal mines, quarries and mills, and sand and gravel mines. Nine fatal injuries occurred, compared with 12 in 1958; all were at coal mines.

Consumption, Trade, and Markets.—There were no notable changes in the marketing pattern of the mineral industry during the year. Most of the mineral production was consumed within the State. Large quantities of bauxite and iron ore entered the State through Mobile from foreign countries, for consumption at Mobile and Birmingham. The Tennessee Valley Authority (TVA) placed in operation at Wilson Dam the highest single lift in the world to raise and lower vessels 100 feet through the dam. This lock broke a major bottleneck in traffic on the Tennessee River, reducing lockage time from as much as 12 hours to 45 minutes.

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[1] Chief, Field Office, Region V, Bureau of Mines, Knoxville, Tenn.
[2] State geologist, Alabama Geological Survey, Tuscaloosa, Ala.

TABLE 1.—Mineral production in Alabama [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry...thousand 376-pound barrels	1,673	$6,368	1,820	$6,967
Portland...do	11,915	36,562	12,998	39,672
Clays [2]	1,548	1,788	1,786	2,089
Coal	11,182	72,359	11,947	78,212
Gem stones	------	------	(3)	(4)
Iron ore (usable)...thousand long tons, gross weight	3,659	23,393	4,165	23,922
Lime	520	[5] 5,851	579	6,847
Mica (sheet)...pounds	(6)	(6)	818	7
Natural gas...million cubic feet	[5] 323	30	[7] 320	[7] 30
Petroleum (crude)...thousand 42-gallon barrels	5,887	(6)	[7] 5,019	(6)
Sand and gravel	4,129	4,210	4,352	4,594
Stone [8]	11,080	17,068	11,886	18,728
Value of items that cannot be disclosed: Asphalt (native), bauxite, slag cement, clay (kaolin), mica (scrap), salt, stone (dimension limestone, dimension marble, oystershell, crushed sandstone, and dimension sandstone (1958)), talc, and values indicated by footnote 6	------	26,508	------	23,860
Total, Alabama [9]	------	[5] 188,938	------	199,319

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin.

[3] Weight not recorded.

[4] Less than $1,000.

[5] Revised figure.

[6] Figure withheld to avoid disclosing individual company confidential data.

[7] Preliminary figure.

[8] Incomplete figures; excludes dimension limestone, dimension marble, oystershell, crushed sandstone, and dimension sandstone (1958).

[9] The total has been adjusted to eliminate duplications in the values of clays and stone.

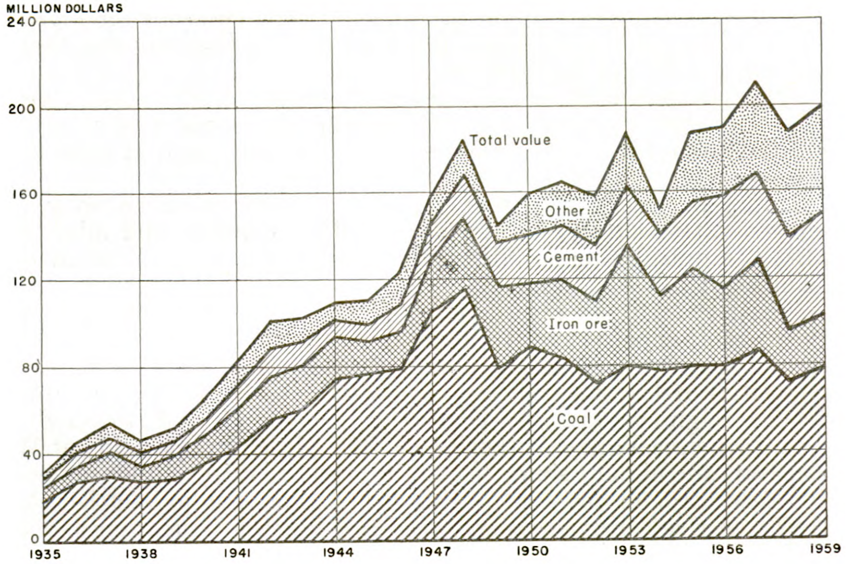

FIGURE 1.—Value of coal, iron ore, cement, and total value of mineral production in Alabama, 1935–59.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
	1958						
Coal mines	196	7,227	186	10,589,431	8	157	16
Quarries and mills	63	3,343	262	7,020,058	----------	125	18
Metal mines	33	3,004	180	4,331,631	1	23	6
Coke ovens and smelters	7	1,466	363	4,253,760	1	21	5
Sand and gravel mines	32	535	271	1,161,274	2	25	23
Nonmetal mines	34	646	227	1,170,383	----------	30	26
Total	365	16,221	221	28,526,537	12	381	14
	1959 [1]						
Coal mines	208	6,954	210	11,663,466	9	155	14
Quarries and mills	56	3,365	282	7,594,992	----------	106	14
Metal mines	44	2,871	183	4,209,034	----------	38	9
Coke ovens and smelters	7	1,544	361	4,461,826	----------	33	7
Sand and gravel mines	37	502	275	1,104,259	----------	21	19
Nonmetal mines	44	950	234	1,774.720	----------	56	31
Total	396	16,186	238	30,808,297	9	409	14

[1] Preliminary figures.

Trends and Developments.—Imported iron ore continued to displace local red iron ore at Birmingham and exceeded production of red iron ore for the first time.

Legislation and Government Programs.—The National System of Interstate and Defense Highways Program was partly responsible for expanded production of aggregates. Of 873 miles of four-lane, limited-access highways designated for the State, 27 miles was completed during the year, 158 miles was under construction, plans were approved for 46 miles, and 126 miles was programmed.

The Bureau of Mines' Tuscaloosa Metallurgy Research Center continued work on research projects of national and regional importance.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt (Native).—Alabama Asphaltic Limestone Co. (Margerum quarry) crushed bituminous limestone in Colbert County for roadstone. Alabama ranked third among the States in production of native asphalt.

Coal.—Bituminous coal was mined at 187 mines in 10 counties, compared with 141 mines in 9 counties in 1958. Leading counties were Jefferson, Walker, and Tuscaloosa. Leading companies were Tennessee Coal & Iron Division of United States Steel Corp., Alabama By-Products Corp., and Alabama Power Co., which together mined 45 percent of the State total. Production increased 7 percent above 1958 but was 43 percent below 1926, the record year. Average output per mine decreased from 79,300 tons in 1958 to 63,900 tons in 1959.

Underground mines produced 77 percent of the total and strip mines 23 percent. Eighty-one percent of the coal was shipped by rail or water, 13 percent by conveyor belt, and 6 percent by truck. Captive tonnage was 56 percent of the total.

Equipment used at 145 underground mines included 185 cutting machines, which cut 84 percent of the tonnage; 229 power drills, which drilled 84 percent; 298 locomotives; 187 shuttle cars; 24 rope hoists; 46 mother conveyors; 109 mobile loading machines, which loaded 76 percent; 20 continuous mining machines, which loaded 14 percent; and 72 face conveyors, which loaded 4 percent.

Equipment used at 39 strip mines included 85 power shovels, 16 draglines, 4 carryall scrapers, 52 bulldozers, 36 power drills, and 106 trucks. An estimated 33,729,000 cubic yards of overburden was excavated.

Three coal-recovery augers were used at three auger mines.

Coal cleaned at 33 cleaning plants amounted to 89 percent of the State's production. Fifty-four percent was crushed, and 1 percent was treated with oil.

Southern Electric Generating Co. opened a new mine near Parrish to supply coal for the new generating plant at Wilsonville.

TABLE 3.—Coal production by counties

County	1958		1959	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Bibb	22,976	$109	28,232	$119
Blount	232,830	1,549	224,687	1,309
Cullman	21,134	133	75,353	403
Jackson	15,000	78	14,901	77
Jefferson	7,060,092	47,045	7,513,267	51,451
Marion	203,505	1,057	187,961	1,248
St. Clair	-----	-----	-----	-----
Shelby	74,697	536	65,772	429
Tuscaloosa	729,277	3,186	664,180	3,004
Walker	2,822,432	18,666	3,060,250	19,590
Winston	-----	-----	112,537	582
Total	11,181,943	72,359	11,947,140	78,212
Earliest record to date	934,688,000	(1)	946,634,000	(1)

[1] Data not available.

Coke.—Six companies produced byproduct metallurgical coke at seven plants in Etowah, Jefferson, and Tuscaloosa Counties. Leading coke producers were Tennessee Coal & Iron Division of United States Steel Corp. and U.S. Pipe and Foundry Co.

Natural Gas.—Marketed production of natural gas from Marion County was about the same as in 1958, the record year.

Petroleum.—Production of crude petroleum was 15 percent below the record output of 1958. Leading counties were Mobile and Escambia. During the year 56 new producing wells were drilled. The 344 producing wells were located in the following counties: Baldwin 5, Choctaw 68, Clarke 12, Escambia 36, and Mobile 223. During the year 34 dry holes were drilled.

Gulf Oil Corp. sold its interests in the Citronelle oilfield during the year to Jett Drilling Co. and B. B. Chamberlain, Jr. The sale involved 48 producing wells and interests in 21 other wells.

NONMETALS

Cement.—Seven companies produced masonry cement at eight plants in four counties. Leading producers were Southern Cement Co. Division of American-Marietta Co. and National Cement Co. Shipments increased 9 percent over 1958 but were 6 percent below 1955, the record year. Consumption of masonry cement in Alabama amounted to 22 percent. Shipments were made to Georgia (29 percent), South Carolina (10 percent), Florida (10 percent), Louisiana (9 percent), Mississippi (8 percent), North Carolina (7 percent), and other States (5 percent).

TABLE 4.—Production of crude petroleum by counties in 42-gallon barrels[1]

County	1958	1959
Baldwin	38,392	48,941
Choctaw	360,543	308,299
Clarke	88,693	87,309
Escambia	761,523	698,150
Mobile	4,637,849	3,876,301
Total	5,887,000	5,019,000
Earliest record to date	20,946,000	25,965,000

[1] Data from State Oil & Gas Board.

Seven companies produced portland cement at eight plants in five counties. Leading producers were Ideal Cement Co. (Mobile plant) and Lone Star Cement Corp. (Birmingham and Demopolis plants). Shipments were 9 percent above 1958 and 6 percent above 1956, the previous record year. Consumption in Alabama accounted for 39 percent of the output; the remainder was shipped to Georgia (21 percent), Florida (16 percent), Mississippi (12 percent), Louisiana (5 percent), and other States (7 percent). Raw materials used in portland cement included limestone and oystershell (48 percent), cement rock (33 percent), clay and shale (12 percent), and other materials (7 percent).

A special study of the end uses of portland cement showed the following distribution: Ready-mixed concrete (49 percent), concrete products (19 percent), highway contractors (15 percent), building-materials dealers (11 percent), and other uses (6 percent).

Southern Cement Co. Division of American-Marietta and Cheney Lime & Cement Co. produced slag cement. Shipments were 6 percent below 1958 and 30 percent below 1952, the record year.

Annual capacity of Alabama's portland cement plants increased from 14,869,000 to 15,823,000 barrels. Southern Cement Co. installed a new 1,250,000 barrel kiln at the Roberta plant during the year.

Clays.—Twelve companies mined fire clay at 13 mines in 7 counties. Leading producers were Donoho Clay Co. and Russell Coal & Clay Co. Production increased 18 percent over 1958 but was 8 percent below the record output of 1956. A. P. Greene Fire Brick Co. acquired Dixie Fire Brick Co., Inc., during the year.

Harbison-Walker Refractories Co. and Thomas Alabama Kaolin Co. mined kaolin for floor and wall tile, firebrick and block, paper filling, fertilizer, and insecticides. Production was 92 percent above 1958 and 59 percent above 1953, the previous record year.

TABLE 5.—Finished portland cement produced, shipped, and in stock

Year	Production	Shipments from mills		Stocks at mills on Dec. 31
	Thousand barrels	Thousand barrels	Value (thousands)	Thousand barrels
1950–54 (average)	10,687	10,671	$25,413	605
1955	12,161	11,782	31,517	535
1956	12,969	12,312	35,256	750
1957	11,965	11,382	34,238	905
1958	12,372	11,915	36,562	981
1959	13,461	12,998	39,672	1,002

Twenty-one companies mined 1,508,000 tons of miscellaneous clay at 22 mines in 12 counties. Leading producers were Bickerstaff Brick Co., Southern Cement Co. Division of American Marietta Co., and Dixie Brick Co. The clay was used for portland cement and heavy clay products. Production increased 15 percent over the previous high output of 1958. Jenkins Brick Co. completed a new brick plant at Coosada, 14 miles north of Montgomery. W. S. Dickey, whose Birmingham plant was destroyed by fire in November, started work on a new plant at Bessemer which will produce sewer pipe and other clay products.

Gem Stones.—A small quantity of flint was collected.

Lime.—Seven companies produced quicklime and hydrated lime at eight plants in three counties. Leading producers were Southern Cement Co. (Roberta and Keystone limekilns) and Longview Lime Corp. Production increased 11 percent over 1958 and 5 percent over 1957, the previous record year. Consumption in Alabama accounted for 54 percent of production; the remainder was shipped to Florida (17 percent), Georgia (11 percent), Tennessee (8 percent), Mississippi (4 percent), Louisiana (3 percent), Puerto Rico, and foreign countries and other States (3 percent). Ideal Cement Co. closed the Mobile limekiln during the year.

Magnesium Compounds.—Tennessee Coal & Iron Division of United States Steel Corp. produced dead-burned dolomite for refractory use.

TABLE 6.—Fire clay sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Firebrick and block	100,580	$268,415	$2.67	(1)	(1)	(1)
Fire-clay mortar	45,901	117,802	2.57	81,564	$210,455	$2.58
Foundries and steelworks	(1)	(1)	(1)	26,444	51,746	1.96
Other [2]	89,535	231,781	2.59	169,636	474,901	2.80
Total	236,016	617,998	2.62	277,644	737,102	2.65

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes heavy clay products, other refractories, and figures indicated by footnote 1.

TABLE 7.—Lime sold or used by producers, by uses

Use	1958[1]			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Chemical and industrial	423,298	$4,750,720	$11.22	453,830	$5,334,726	$11.75
Other[2]	96,872	1,100,749	11.36	125,252	1,512,603	12.08
Total	520,170	5,851,469	11.25	579,082	6,847,329	11.82

[1] Figures for 1958 revised except for total tonnage.
[2] Includes construction, agricultural, and refractory lime in 1958; no refractory lime production in 1959.

Mica.—Dixie Mines, Inc., mined scrap mica at the Dixie mine; production increased 13 percent over the previous peak output of 1958. Among the States, Alabama ranked third in the production of scrap mica. Six operators mined sheet mica; the leading producer was Dixie Mines, Inc. (Red Indian, Arnott, and Shaffer mines); production was about the same as in 1958.

Salt.—Olin Mathieson Chemical Corp., the State's only salt producer, has increased production each year since 1952. Production increased 6 percent over 1958, the previous record year.

Sand and Gravel.—Thirty-two companies mined sand and gravel at 37 mines in 22 counties. Leading producers were Radcliff Gravel Co., Inc., Alabama Gravel Co., and Birmingham Slag Division of Vulcan Materials Co. Leading counties were Mobile, Montgomery, and Elmore. Production was 5 percent above 1958 but 14 percent below 1957, the record year. Of the total production, 97 percent was washed. Fifty-nine percent was shipped by truck and 41 percent by rail or water.

Stone.—Thirty-three operators crushed limestone at 40 quarries in 20 counties. Leading counties were Shelby, Jefferson, and Madison. Leading producers were Birmingham Slag Division of Vulcan Materials Co., Lone Star Cement Corp., and Southern Cement Co. Production increased 7 percent over 1958, the previous record year. Of the total production, 63 percent was shipped by truck, 24 percent by rail or water, and 13 percent by conveyor belt.

Alabama Limestone Co. quarried dimension limestone for rubble, rough architectural stone, and dressed building stone. Production was 12 percent below 1956, the record year. During the year the company was acquired by Georgia Marble Co.

Thompson-Weinman & Co., Moretti-Harrah Marble Co., and Alabama Marble Co. crushed marble at Sylacauga for whiting, terrazzo, and other uses. Production increased 38 percent over 1958, the previous record year.

Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for rough exterior and dressed interior building stone and for cut, dressed monumental stone. Production increased 4 percent over 1958, the previous peak year.

Bay Towing & Dredging Co., Inc., and Southern Oystershell Milling Corp. crushed oystershell from Mobile Bay for cement, lime, concrete and roadstone, and poultry grit. Production declined 43 percent below 1958 and 53 percent below 1957, the record year.

Universal Atlas Cement and Sam P. Acton crushed sandstone for cement and refractories. Production increased 10 percent over 1958.

TABLE 8.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Baldwin	8,320	$7,738	10,400	$10,400
Barbour	---	---	258,007	281,875
Calhoun	187,011	155,985	173,693	199,461
Cherokee	(1)	(1)	(1)	(1)
Chilton	---	---	(1)	(1)
Clarke	36,893	39,122	11,119	12,432
Dallas	---	---	374,908	377,203
Elmore	---	---	(1)	(1)
Escambia	(1)	(1)	(1)	(1)
Etowah	---	---	(1)	(1)
Franklin	---	---	(1)	(1)
Greene	---	---	(1)	(1)
Houston	---	---	40,500	34,425
Jefferson	---	---	181,591	203,110
Macon	59,240	69,566	83,380	104,990
Mobile	---	---	(1)	(1)
Monroe	18,900	17,000	21,842	20,605
Montgomery	807,705	802,690	591,086	592,295
Morgan	---	---	(1)	(1)
Russell	---	---	(1)	(1)
St. Clair	2,265	5,097	1,297	2,918
Sumter	30,000	24,300	---	---
Tuscaloosa	---	---	228,228	250,900
Undistributed	2,978,232	3,088,510	2,375,674	2,502,922
Total	4,128,566	4,210,008	4,351,725	4,593,536

(1) Figure withheld to avoid disclosing individual company confidential data; include with "Undistributed."

TABLE 9.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,266,812	$1,076,322	$0.85	1,479,254	$1,288,768	$0.87
Paving	579,599	464,690	.80	462,278	410,114	.89
Molding	(1)	(1)	(1)	130,341	214,635	1.65
Engine	41,852	27,275	.65	52,624	34,206	.65
Railroad ballast	(1)	(1)	(1)	9,859	5,172	.52
Fill	---	---	---	7,912	4,641	.59
Gravel:						
Structural	1,244,572	1,474,867	1.19	1,209,746	1,447,027	1.20
Paving	654,732	784,767	1.20	782,966	940,790	1.20
Railroad ballast	66,135	46,341	.70	(1)	(1)	(1)
Fill	---	---	---	2,034	2,179	1.07
Other sand and gravel	274,864	335,746	1.22	214,711	246,004	1.15
Total	4,128,566	4,210,008	1.02	4,351,725	4,593,536	1.06

(1) Figure withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

A. O. Brown quarried dimension sandstone for rough architectural building stone. Production declined 58 percent below 1958 and 91 percent below 1954, the record year.

Talc.—American Talc Co. mined and ground talc at Winterboro for insecticides, paint, textiles, toilet preparations, and other uses. Production doubled and set a new annual record.

Vermiculite.—Zonolite Co. operated a vermiculite expanding plant at Birmingham, using vermiculite from South Carolina and Montana.

TABLE 10.—Crushed limestone sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Blount	23,998	$28,318	(1)	(1)
Chilton	19,744	39,488	-----	-----
Colbert	740,074	931,494	555,842	$673,162
Conecuh	(1)	(1)	(1)	(1)
Covington	(1)	(1)	(1)	(1)
DeKalb	(1)	(1)	(1)	(1)
Etowah	319,388	470,209	(1)	(1)
Franklin	(1)	(1)	(1)	(1)
Henry	9,000	24,000	20,000	51,000
Jackson	344,922	297,663	133,646	165,570
Jefferson	3,042,144	3,107,923	3,218,261	3,412,566
Lawrence	-----	-----	(1)	(1)
Lee	165,613	188,681	(1)	(1)
Limestone	61,069	85,497	49,235	73,853
Madison	(1)	(1)	(1)	(1)
Marengo	(1)	(1)	(1)	(1)
Marshall	(1)	(1)	(1)	(1)
Morgan	644,610	651,774	(1)	(1)
St. Clair	(1)	(1)	(1)	(1)
Shelby	2,717,468	4,053,850	3,305,836	4,615,918
Talladega	(1)	(1)	-----	-----
Washington	(1)	(1)	(1)	(1)
Undistributed	2,769,190	3,324,179	4,295,473	5,100,743
Total	10,857,220	13,203,076	11,578,293	14,092,812

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 11.—Crushed limestone sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	4,381,270	$5,665,327	$1.29	4,929,833	$6,395,036	$1.30
Cement manufacture	3,274,529	2,650,307	.81	3,580,832	3,066,724	.86
Fluxing stone	1,340,816	2,087,899	1.56	1,267,422	1,788,673	1.41
Lime manufacture	782,233	988,601	1.26	833,375	1,113,160	1.34
Agstone	516,258	787,832	1.53	604,757	918,015	1.52
Rock dust for coal mines	56,918	246,169	4.32	67,256	285,754	4.25
Riprap	49,574	76,058	1.53	(1)	(1)	(1)
Asphalt filler	81,364	249,370	3.06	57,078	167,295	2.93
Railroad ballast	6,873	10,183	1.48	(1)	(1)	(1)
Mineral food	1,829	4,325	2.36	-----	-----	-----
Other uses [2]	365,556	437,005	1.20	237,740	358,155	1.51
Total	10,857,220	13,203,076	1.22	11,578,293	14,092,812	1.22

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes refractory, paper, alkali, stone sand, and uses indicated by footnote 1.

METALS

Aluminum.—Reynolds Metals Co. operated the Listerhill aluminum reduction plant at Sheffield.

Bauxite.—R. E. Wilson Mining Co., D. M. Wilson Bauxite Co., and Harbison-Walker Refractories Co. mined crude bauxite in Barbour and Henry Counties. Production increased 26 percent. Among the States, Alabama ranked second in bauxite production.

Ferroalloys.—Shipments of ferromanganese, silicomanganese, ferrosilicon, and ferrophosphorus totaled 131,400 short tons valued at $28,358,000.

Iron Ore.—Shipments of iron ore increased 14 percent over 1958 but were 53 percent below 1942, the record year. Of the total shipments, 50 percent was direct-shipping ore, compared with 58 percent in 1958. The number of active mines increased from 31 to 35, and average usable production per mine increased from 117,000 to 119,000 tons. Alabama ranked third among the States in iron-ore production. Cumulative shipments since 1840 have totaled 354,113,000 long tons valued at $903,744,000.

Five companies mined red iron ore (hematite) at six mines in Jefferson and Tuscaloosa Counties. Leading producers were Tennessee Coal & Iron Division of United States Steel Corp. (Wenonah mine) and Woodward Iron Co. (Pyne mine). Production decreased 11 percent below 1958 and 63 percent below 1942, the record year, to the lowest figure since 1934.

Twenty-four operators mined brown iron ore (limonite) for iron and steel at 29 mines in 9 counties. Leading counties were Butler and Pike. Leading producers were Shook & Fletcher Supply Co. (Taits Gap, Blackburn, and Adkins mines), Glenwood Mining Co., Inc. (Greenville, Glenwood, and Springhill mines), and Pigeon Creek Mining Co. (Butler and Luverne mines). Shipments were nearly three times those of 1958 but were 31 percent below 1942, the record year.

Magnesium.—Alabama Metallurgical Corp. completed a plant at Selma for manufacturing magnesium from dolomite obtained from the company's deposit near Ryan.

Pig Iron and Steel.—Tennessee Coal & Iron, U.S. Pipe & Foundry Co., Republic Steel Corp., and Woodward Iron Co. produced 3,658,000 tons of foundry, basic, low-phosphorus, and direct-casting pig iron, compared with 3,412,000 tons in 1958. Value of shipments was $206,450,000, compared with $188,150,000 in 1958. Iron ore consumed in blast and steel furnaces and agglomerating plants was 67 percent domestic and 33 percent imported. Iron ore imports, mainly from Venezuela and Liberia, increased 34 percent over 1958, the previous record year.

Republic Steel Corp. announced that it would move its iron ore sintering plant from Birmingham to Gadsden. Woodward Iron Co. acquired Alabama Pipe Co. and an interest in Central Foundry Co., the Nation's two largest shippers of cast-iron soil pipe.

TABLE 12.—Shipments of usable iron ore, by counties

County	1958		1959	
	Long tons	Value	Long tons	Value
Barbour	21,581	$102,098	52,617	$252,373
Blount			(1)	(1)
Butler	83,171	453,771	273,463	1,439,200
Calhoun			10,423	63,311
Crenshaw			(1)	(1)
Franklin			(1)	(1)
Jefferson	(1)	(1)	2,970,839	17,399,630
Pike	228,093	1,115,545	232,146	1,128,638
Shelby			(1)	(1)
Tuscaloosa			(1)	(1)
Undistributed	3,326,627	21,721,553	625,836	3,638,643
Total	3,659,472	23,392,967	4,165,324	23,921,795

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 13.—Mine production and shipments of crude iron ore

	1958		1959	
	Number of mines	Long tons	Number of mines	Long tons
Mine production:				
By varieties:				
Hematite	6	3,206,838	6	3,194,835
Limonite	25	1,971,996	29	4,251,353
By mining methods:				
Open-pit	26	2,051,852	31	4,383,792
Underground	5	3,126,982	4	3,062,396
Shipment from mines:				
Direct to consumers	8	2,123,226	6	2,088,390
To beneficiation plants	23	3,051,037	29	5,351,140

TABLE 14.—Production and shipments of usable iron ore

	1958		1959	
	Long tons	Iron content, natural (percent)	Long tons	Iron content, natural (percent)
Production:				
Hematite	3,139,777	36	2,803,278	36
Limonite	493,376	46	1,362,046	46
Shipments:				
Direct shipping ore	2,123,226	36	2,088,390	36
Concentrates	1,536,246	40	2,076,934	42
Sinter	(1)	42	(1)	42

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Concentrates."

REVIEW BY COUNTIES

Mineral production was reported from 51 of the State's 67 counties, compared with 48 in 1958. Leading counties were Jefferson (which supplied 50 percent of the total value), Mobile, Walker, and Shelby.

Baldwin.—Crude petroleum production from five producing oil wells was 27 percent more than in 1958; no new producing wells were drilled during the year. Hinote Sand Supply Co. produced building sand. Fairhope Clay Products Co. (Fairhope mine) mined miscellaneous clay for heavy clay products.

Barbour.—R. E. Wilson Mining Co. and D. M. Wilson Bauxite Co. mined bauxite for chemicals and refractories. McKenzie Construction Co. (Eufaula mine) mined building, paving, and fill sand and building gravel. Four companies mined brown iron ore for iron and steel; leading producers were Glenwood Mining Co., Inc. (Louisville mine) and Rucker Mining Co. (Clio mine). Harbison-Walker Refractories Co. mined refractory kaolin for firebrick and block.

Bibb.—Five mines produced coal; leading producers were the Belle Ellen No. 9 mine (H. E. Hicks Coal Co.) and the Belle Ellen No. 5 mine (Hicks Coal Co.).

Blount.—Five mines produced coal; leading producers were the Southview strip mine(Robbins Coal Co., Inc.) and the Hopewell Strip mine (Alabama Coal & Ore Co., Inc.). Birmingham Slag opened the Bangor quarry and crushed limestone for concrete and roads. Cheney Lime & Cement Co. produced masonry and slag cement at the Graystone mill. Shook & Fletcher Supply Co. (Taits Gap mine) mined brown iron ore for sale to iron and steel plants. Harbison-Walker Refractories Co. (Thermal mine) and Lehigh Coal Co. (Trafford mine) mined fire clay for firebrick and block and for other refractories. A. O. Brown quarried dimension sandstone for rough architectural building stone.

Butler.—Nine companies mined brown iron ore for pig iron and steel; leading producers were KMC Mining Co. (Greenville mine) and Woodward-Acree Mining Co. (Woodward-Acree mine).

Calhoun.—Donoho Foundry Co. (Anniston mine) mined fire clay for fire-clay mortar. Wade Sand & Gravel Co., Inc. (Ohatchee mine), John B. Lagarde, Inc., and the Alabama State Highway Department mined building and paving sand and building gravel. Pope & Sublett, J. E. and F. D. Brown, and B. F. Sweet mined brown iron ore for pig iron and steel. Agricola Brick Co. mined miscellaneous clay for brick manufacture.

Cherokee.—Wolf Creek Sand Co. and the State highway department mined molding and paving sand.

Chilton.—Southeastern Sand-Gravel Co. mined building and paving sand and building, paving, and fluxing gravel.

Choctaw.—Crude-petroleum production from 68 producing oil wells was 14 percent less than in 1958. Two new producing wells were drilled during the year.

Clarke.—Crude-petroleum production from 12 producing oil wells decreased 2 percent below 1958; 4 new producing wells were drilled during the year. Paul Sand & Gravel Co. (Grove Hill mine) and the State highway department mined building sand and gravel.

Clay.—Joe L. Snyder (M & G mine) and L. T. Bounds (Hurst mine) mined a small quantity of sheet mica.

Cleburne.—Dixie Mines, Inc. (Red Indian mine) mined sheet mica.

Colbert.—Ralph Rogers & Co., Inc. (Tuscumbia quarry), Alabama Asphaltic Limestone Co. (Maloney quarry), and Tri-State Limestone, Inc. (Tuscumbia quarry) crushed limestone for riprap, concrete and roads, railroad ballast, agstone, and stone sand. Alabama

Asphaltic Limestone Co. (Margerum quarry) mined native asphalt for roadstone.

Conecuh.—Conecuh Lime Co., Inc. (Evergreen quarry) crushed limestone for agstone.

TABLE 15.—Value of mineral production in Alabama, by counties[1]

County	1958	1959	Mineral production in 1959 in order of value
Baldwin	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Barbour	(2)	(2)	Bauxite, sand and gravel, iron ore, kaolin.
Bibb	$108,676	$118,856	Coal.
Blount	2,340,007	2,342,146	Coal, iron ore, limestone, cement, fire clay, sandstone.
Butler	453,771	1,439,200	Iron ore.
Calhoun	345,822	482,619	Fire clay, sand and gravel, iron ore, miscellaneous clay.
Cherokee	(2)	(2)	Sand and gravel.
Chilton	(2)	(2)	Do.
Choctaw	(2)	(2)	Petroleum.
Clarke	----	(2)	Petroleum, sand and gravel.
Clay	3,336	(2)	Mica.
Cleburne	(2)	(2)	Do.
Colbert	(2)	(2)	Limestone, native asphalt.
Conecuh	(2)	(2)	Limestone.
Coosa	(2)	(2)	Mica.
Covington	(2)	(2)	Limestone.
Crenshaw	(2)	(2)	Iron ore.
Cullman	133,258	403,329	Coal.
Dallas	(2)	377,203	Sand and gravel.
De Kalb	(2)	(2)	Limestone.
Elmore	(2)	(2)	Sand and gravel, miscellaneous clay.
Escambia	(2)	(2)	Petroleum, sand and gravel, miscellaneous clay.
Etowah	(2)	(2)	Limestone, sand and gravel.
Franklin	1,531,468	2,267,346	Limestone, iron ore, sand and gravel, fire clay, gem stones.
Greene	----	(2)	Sand and gravel.
Henry	24,000	(2)	Bauxite, limestone.
Houston	(2)	34,425	Sand and gravel.
Jackson	375,813	243,204	Limestone, coal.
Jefferson	[3] 96,590,374	99,192,275	Coal, cement, iron ore, limestone, lime, miscellaneous clay, sand and gravel, sandstone, fire clay.
Lawrence	----	(2)	Limestone.
Lee	188,681	(2)	Do.
Limestone	85,497	73,853	Do.
Macon	69,566	104,990	Sand and gravel.
Madison	(2)	(2)	Limestone, miscellaneous clay.
Marengo	(2)	(2)	Cement, limestone.
Marion	(2)	(2)	Coal, kaolin, natural gas.
Marshall	(2)	(2)	Limestone.
Mobile	(2)	(2)	Petroleum, cement, oystershell, sand and gravel, lime, miscellaneous clay.
Monroe	17,000	20,605	Sand and gravel.
Montgomery	(2)	720,657	Sand and gravel, miscellaneous clay.
Morgan	(2)	(2)	Limestone, sand and gravel.
Pike	1,115,545	1,128,638	Iron ore.
Randolph	(2)	(2)	Mica.
Russell	531,673	(2)	Miscellaneous clay, sand and gravel.
St. Clair	(2)	(2)	Cement, limestone, miscellaneous clay, fire clay, sand and gravel.
Shelby	12,573,703	17,255,700	Cement, lime, limestone, coal, miscellaneous clay, iron ore, fire clay.
Sumter	24,300	----	
Talladega	5,136,645	(2)	Marble, talc.
Tuscaloosa	4,154,561	5,080,279	Coal, iron ore, sand and gravel.
Walker	(2)	19,953,360	Coal, fire clay.
Washington	(2)	(2)	Limestone, salt, miscellaneous clay.
Winston	----	581,816	Coal.
Undistributed	63,134,304	47,498,499	
Total	[3] 188,938,000	199,319,000	

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[1] The following counties are not listed because no production was reported: Autauga, Bullock, Chambers, Coffee, Dale, Fayette, Geneva, Hale, Lamar, Lauderdale, Lowndes, Perry, Pickens, Tallapoosa, and Wilcox.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Revised figure.

Coosa.—Grover C. Williams (Bentley mine) and O. G. Abram (Abram mine) mined a small quantity of sheet mica.

Covington.—Miller Lime Pit (Florala quarry) crushed limestone for agstone.

Crenshaw.—Glenwood Mining Co., Inc., and Davis Bros. Mining Co. mined brown iron ore for pig iron and steel.

Cullman.—Seven mines produced coal; leading producers were the No. 2 Strip mine (Marigold Coal, Inc.) and the Drummond Strip mine (H. E. Drummond Coal Co., Inc.).

Dallas.—C. Pierson Cosby and Dallas Sand & Gravel Co., Inc., mined building, paving, railroad ballast, fill, molding, and engine sand and building paving, railroad ballast, filter, and fluxing gravel.

De Kalb.—Miller Limestone Co. (Fort Payne quarry) crushed limestone for concrete and roads.

Elmore.—Alabama Gravel Co. and Birmingham Slag mined building, paving, and molding sand and building, paving and fluxing gravel. Jenkins Brick Co. opened a new mine and produced miscellaneous clay for brick manufacture.

Escambia.—Crude petroleum production from 36 producing oil wells declined 8 percent below 1958; no new producing wells were drilled during the year. Dixie Sand & Gravel Co. and Flomaton Gravel mined building, paving, and fill sand and building, paving, railroad ballast, and fill gravel. Keego Clay Products Co. mined miscellaneous clay for heavy clay products.

Etowah.—Alabama Aggregate Co. Division of McCullough Industries (Cobb City quarry) and Double R. Co. crushed limestone for concrete and roads, riprap, fluxing stone, agstone, asphalt filler, and other uses. Milner Sand Co. mined building and molding sand and building gravel.

Franklin.—Clark & Ford, Inc. (Isbell quarry) and Alabama Limestone Co. crushed limestone for riprap, concrete and roads, agstone, and asphalt filler. Alabama Limestone Co. quarried dimension limestone for rubble, rough architectural stone, veneer, and cut and sawed building stone. Shook & Fletcher Supply Co. (Blackburn mine) and Hester & Farned mined brown iron ore for pig iron and steel. Tennessee Valley Sand & Gravel Co. (Spruce Pine mine) mined building and paving sand and gravel. Tennessee Valley Sand & Gravel Co. mined fire clay for fire-clay mortar. A few gem stones (flint) were collected.

Greene.—L. C. Smith Sand & Gravel Co. (Dothan mine) and Akron Sand Co. (Gainesville mine) mined building and fill sand and building and paving gravel.

Henry.—Harbison-Walker Refractories Co. mined bauxite for refractories. Abbeville Lime Co. crushed limestone for agstone.

Houston.—Speigner Concrete Block Co. mined building sand.

Jackson.—The State highway department (Paint Rock Creek quarry) crushed limestone for concrete and roads. Widows Creek Coal Co. (Armstrong mine) and Trussell Coal Co. (No. 1 mine) mined coal.

Jefferson.—Seventy-five mines produced coal. Leading producers were the Maxine mine (Alabama By-Products Corp.), the Concord

No. 1 mine (Tennessee Coal & Iron), and the Mulga mine (Woodward Iron Co.).

Four companies produced portland cement; leading producers were Universal Atlas Cement Co. (Leeds mill) and Lone Star Cement Corp. (Birmingham mill). Five companies produced masonry cement; leading producers were Southern Cement Co. (North Birmingham mill) and Lone Star Cement Corp. (Birmingham mill). Slag cement was produced by Southern Cement Co. (North Birmingham mill).

Five mines produced red iron ore. Leading producers were Tennessee Coal & Iron (Wenonah mine) and Woodward Iron Co. (Pyne and Songo mines).

Eight quarries crushed limestone for cement, concrete and roads, fluxing stone, agstone, rock dust for coal mines, lime, refractories, and railroad ballast. Leading producers were Dolcito Quarry Co., Tennessee Coal & Iron (Dolonah quarry), and Universal Atlas Cement Co. (Leeds quarry).

Tennessee Coal & Iron (Ensley works) produced quicklime for chemical and industrial use.

Six companies mined miscellaneous clay for cement and heavy clay products. Leading producers were Lehigh Portland Cement Co. and Universal Atlas Cement.

Wade & Vance Sand & Gravel Co., Inc., opened a new mine at Bessemer and produced building sand and gravel.

Universal Atlas Cement and Sam P. Acton crushed sandstone for cement and refractories.

Dixie Fire Brick Co., Inc., Bibby Coal, Shale & Clay Co., and W. S. Dickey Clay Co. mined fire clay for fire brick and block, fireclay mortar, and heavy clay products.

Tennessee Coal & Iron (Ensley works) produced magnesium compounds (dead-burned dolomite).

Zonolite Co. operated a plant for exfoliated vermiculite at Birmingham, using materials from South Carolina and Montana.

Lawrence.—Birmingham Slag opened a new quarry at Danville and crushed limestone for concrete and roads.

Lee.—Birmingham Slag (Auburn quarry) crushed limestone for concrete and roads.

Limestone.—Limestone County Board of Revenue crushed limestone for concrete and roads.

Macon.—Sharpe Sand & Gravel Co. and Tri-State Sand Co. (Hurtsboro mine) mined building, paving, and molding sand and building and paving gravel.

Madison.—Madison Limestone Co. (Pluski & Airport quarries) crushed limestone for concrete and roads. Alabama Brick & Tile Co. (Farley mine) and Huntsville Brick & Tile Co., Inc., mined miscellaneous clay for heavy clay products.

Marengo.—Lone Star Cement Corp. produced portland cement at the Demopolis mill and crushed limestone for use in making cement.

Marion.—Thirty mines produced coal; leading producers were the Brilliant strip mine (Webb Excavating Co.), the New River strip mine (Brookside-Pratt Mining Co.), and the Ed Weeks mine (Ed Weeks Coal Co.). Thomas Alabama Kaolin Co. operated the

Hackelburg mine during the year and mined kaolin for floor and wall tile, firebrick and block, paper filler, fertilizer fillers, and insecticides. Production of natural gas was about the same as in 1958.

Marshall.—C. A. Langford crushed limestone for concrete and roads.

Mobile.—Crude petroleum output from 223 producing oil wells was 12 percent less than in 1958; during the year 50 new producing wells were drilled. Ideal Cement Co. produced portland cement at the Mobile mill, using oystershell dredged from Mobile Bay; lime at the Mobile limekiln from oystershell; and miscellaneous clay for use in making cement. Bay Towing & Dredging Co. dredged oystershell from Mobile Bay for manufacturing cement and lime and for concrete and roads. Radcliff Gravel Co., Inc., mined building and paving sand and gravel.

Monroe.—Mannings Sand & Gravel Co. mined building sand and gravel.

Montgomery.—Five companies mined building and paving sand and gravel; leading producers were Alabama Gravel Co. and Birmingham Slag. Jenkins Brick Co. and Excelsior Brick Co. mined miscellaneous clay for heavy clay products.

Morgan.—Trinity Stone Co., Inc., and Waters Quarries, Inc., crushed limestone for riprap, concrete and roads, agstone, and stone sand. Decatur Sand & Gravel Co. mined building and paving sand and gravel.

Pike.—Six mines produced brown iron ore for iron and steel plants. Leading producers were Glenwood Mining Co., Inc., and Dunbar & Layton.

Randolph.—Dixie Mines, Inc., (Dixie mine) mined scrap mica. Dixie Mines, Inc., (Shaffer and Arnott mines) and J. J. New (New mine) mined sheet mica.

Russell.—Bickerstaff Brick Co., Dixie Brick Co., and Bickerstaff Co., Inc., mined miscellaneous clay for heavy clay products. Consolidated Gravel Co., Inc., (Dixieland mine) mined building, paving, and railroad-ballast sand and building and paving gravel.

St. Clair.—National Cement Co. produced masonry and portland cement at the Ragland mill and crushed limestone for cement. National Cement Co. and Ragland Brick Co. mined miscellaneous clay for cement and heavy clay products. Riverside Clay Co. mined fire clay for foundries and steelworks. Wolf Creek Sand Co. mined a small quantity of molding sand.

Shelby.—Southern Cement Co. produced masonry and portland cements at the Calera mill. Six limekilns produced quicklime and hydrated lime for agricultural, building, chemical, and industrial uses; leading producers were Southern Cement Co. (Roberta limekiln) and Longview Lime Corp. (Saginaw limekiln). Eight quarries crushed limestone for concrete and roads, agstone, papermills, cement, lime, riprap, fluxing stone, railroad ballast, asphalt filler, rock dust for coal mines, and stone sand; leading producers were Southern Cement Co. (Roberta quarry), Birmingham Slag (Calera quarry), and Longview Lime Corp. (Saginaw A quarry). Twelve mines produced coal; leading producers were the River Valley No. 8 mine (River Valley Coal Co.) and the No. 2 mine (Alabama Red Ash Coal Co.). Southern Cement Co. mined miscellaneous clay for cement. Shelby Sand &

Ore Co. (Shelby mine) mined brown iron ore for iron and steel. Montevallo Clay Co. mined fire clay for foundries and steelworks.

Talladega.—Thompson-Weinman & Co. (Hill quarry), Moretti-Harrah Marble Co., and Alabama Marble Co. crushed marble for terrazzo and other uses. Moretti-Harrah Marble Co. and Alabama Marble Co. quarried dimension marble for rough exterior building stone, sawed and cut dressed interior building stone, and cut dressed monumental stone. American Talc Co. (Winterboro mine) mined a small quantity of talc which was ground for insecticides.

Tuscaloosa.—Nine mines produced coal; leading producers were the Kellerman No. 4 strip mine (Twin Seam Mining Co.), No. 1 strip mine (C. L. Abston Coal Co.), and Mitchell Nos. 2 and 3 strip mines (Mitchell Bros. Construction Co.). Shook & Fletcher Supply Co. (Adkins mine) mined brown iron ore, and Southeastern Coal & Iron Co. (Dudley mine) mined red iron ore to sell to iron and steel plants. Yazoo Gravel Co., Inc., Tuscaloosa Sand & Gravel Co., and Shackleford Construction Co. mined building and molding sand and building gravel.

Walker.—Forty-one mines produced coal; leading producers were the Gorgas mine (Alabama Power Co.), Waterside strip mine (DeBardeleben Coal Corp.), and Empire No. 3 mine (DeBardeleben Coal Corp.). Russell Coal & Clay Co., Natco Corp., Harbison-Walker Refractories Co., and Aaron Clay Co. mined fire clay for firebrick and block.

Washington.—Lone Star Cement Corp. crushed limestone and mined miscellaneous clay. The output was shipped to Louisiana for use in making cement. Mathieson Chemical Corp. recovered salt from brine at its plant near McIntosh.

Winston.—McCoy Coal Co. mined coal at the Winston strip mine.

The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Department of Natural Resources, State of Alaska.

By Alvin Kaufman,[1] Kevin Malone,[2] Phil R. Holdsworth,[3] and
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THE OUTSTANDING event in the mineral industry in 1959 was the discovery of Alaska's first commercial gas field on the Kenai Peninsula by Union Oil Co. of California and Ohio Oil Co. Company reports indicated the field had a production potential exceeding 60 million cubic feet per day from the three wells drilled during the year. Other companies began or continued exploration and drilling activities in Alaska. Oil and gas exploration expenditures increased considerably, compared with 1958. Differences in coverage make it difficult to determine the precise increment; however, oil and gas data for 1958 and 1959 shown in table 2 are not entirely comparable, as 1959 figures represent 100 percent coverage, and include drilling costs.

TABLE 1.—Mineral production in Alaska

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clay .... short tons..	----------	----------	180	$1
Coal, bituminous	759	$6,931	660	5,869
Copper (recoverable content of ores, etc.)...short tons..	5	3	36	22
Gold (recoverable content of ores, etc.) thousand troy ounces..	186	6,525	179	6,262
Lead (recoverable content of ores, etc.)......short tons..	(1)	(2)	----------	----------
Mercury .... 76-pound flasks..	3,380	774	3,743	852
Natural gas .... million cubic feet..	50	6	133	16
Crude petroleum .... thousand 42-gallon barrels..	29	(3)	187	295
Sand and gravel	4,255	3,871	5,859	5,265
Silver (recoverable content of ores, etc.) thousand troy ounces..	24	22	21	19
Stone	615	2,065	89	377
Value of items that cannot be disclosed: Gem stones, crude petroleum (1958), platinum-group metals, uranium ore, and values indicated by footnote 3....	----------	1,253	----------	1,517
Total Alaska	----------	21,450	----------	20,495

[1] Less than 1 ton.
[2] Less than $1,000.
[3] Figure withheld to avoid disclosing individual company confidential data.

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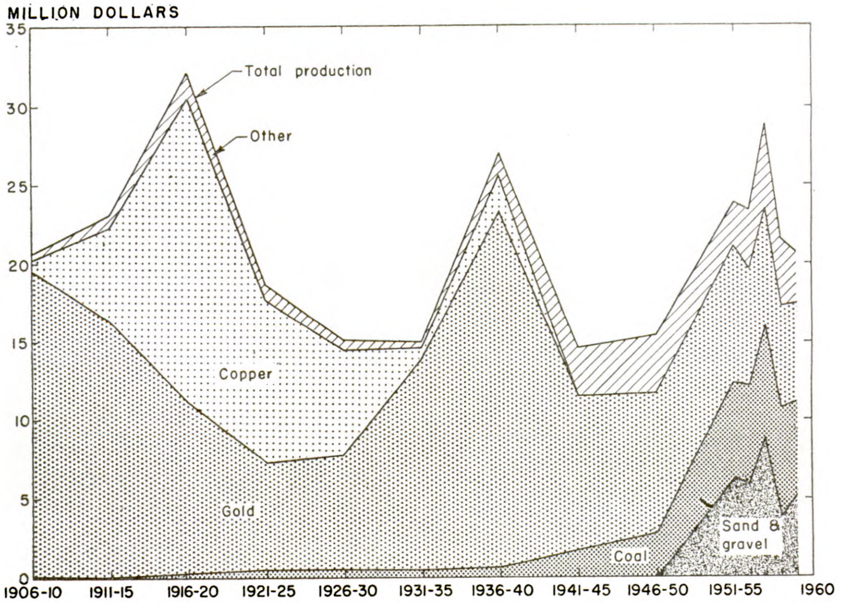

FIGURE 1.—Value of mineral production in Alaska, by major commodities, 1906–55 (five year averages), and 1956–59, by year.

TABLE 2.—Expenditures for exploration and prospecting by major companies[1]

Type and region	Expenditures (thousands)	
	1958	1959
Metals exploration:		
Southeastern	$850	$750
Copper River and Prince William Sound	10	45
Kuskokwim River and Yukon River	110	225
Northwestern	210	260
Other		5
Oil and gas exploration:		
All areas	5, 900	30, 798
Total	7, 080	32, 083

[1] Compiled by the Division of Mines and Minerals, Department of Natural Resources, Alaska.

TABLE 3.—Coastwise receipts and foreign mineral trade [1]

Commodity	1957 Short tons (unless otherwise stated)			1958 Short tons (unless otherwise stated)		
	Coastwise receipts	Imports	Exports	Coastwise receipts	Imports	Exports
Anthracite, bituminous coal and lignite, coal and coke briquettes, and coke	1,413	--------	--------	798	140	--------
Motor fuel and gasoline thousand bbl	1,980	--------	--------	1,790	--------	--------
Gas, oil, distillate, and residual fuel oil do	3,770	--------	(2)	4,089	--------	(2)
Petroleum asphalt	15,701	--------	--------	11,980	--------	--------
Lubricating oil and greases thousand bbl	31	--------	--------	55	--------	--------
Petroleum products, not elsewhere classified thousand bbl	465	--------	--------	266	--------	--------
Building cement 376-lb. bbl	353,904	--------	--------	226,605	1,477	--------
Building, monument, and other stone mfgrs., not elsewhere classified	1,983	--------	--------	2,953	--------	--------
Clays and earths	331	--------	--------	1,849	--------	--------
Brick and tile	1,440	--------	--------	1,220	--------	--------
Sand, gravel, and crushed rock, including limestone	898	--------	--------	83,737	--------	--------
Iron ore and concentrates	132	--------	--------	194	--------	--------
Iron and steel scrap	5,719	--------	12,907	427	--------	9,525
Iron and steel products	1,187	--------	--------	26,505	1,497	--------
Aluminum metal and alloys in crude and semifabricated forms	288	--------	--------	312	--------	--------
Copper semifabricated forms	1,543	--------	--------	814	--------	--------
Lead and lead-base alloys in crude and semifabricated forms	17	--------	--------	54	--------	--------
Other nonferrous ores, concentrates, metals and scrap, except precious, in crude and semifabricated forms	20,442	--------	--------	5	--------	--------
Fertilizer materials	2,071	391	--------	1,240	1,598	--------

[1] Adapted from Waterborne Commerce of the United States, Part 4, Pacific Coast, Alaska, and Pacific Islands, calendar years, 1957–58, by the U.S. Army Corps of Engineers.

[2] Less than 1,000 bbl.

Exploration expenditures for metals increased 9 percent over 1958. This increase was primarily due to activity in the Kuskokwim and Yukon River regions initiated by The Anaconda Co., Humble Oil & Refining Co., and Cordero Mining Co.

Value of mineral output dropped 5 percent from 1958. Declines in coal, gold, and stone production, with consequent drops in value, more than offset increases in sand and gravel, petroleum, uranium ore, and mercury.

In terms of value, gold once again became the leading mineral commodity; coal, the leading commodity in 1958, dropped to second place. These two commodities and sand and gravel, the third-ranking product, accounted for 85 percent of the value of mineral output.

In 1958 (the latest year for which data are available) Alaska merchants imported (primarily from Japan) substantial quantities of cement, structural steel, and fertilizer materials. This trade was probably even greater in 1959; institution of direct shipping service from Japan to Alaska was announced late in the year. Japanese ships, en route to the Japanese-owned pulp mill at Sitka, became available for freight haulage.

TABLE 4.—Employment and injuries in 1959, by types of mines[1]

Type of mine	Number of men working (average)	Average number of days worked	Man days	Injuries (number)	
				Fatal	Nonfatal
Metal:					
Lode	82	127	19,685		4
Mills	6	365	2,281		
Placer:					
Dredge	543	205	111,518		24
Nonfloat	223	103	23,078		3
Hydraulic	13	94	1,220		
Small-scale hand	10	98	980		
Assessment, exploration, development, and/or prospecting[2]	366	83	24,349	1	
Nonmetal[3]	468	143	66,809		1
Quarries and mills	37	103	3.808		
Coal	231	221	51,015	1	47
Total	1,979	154	304,743	2	79

[1] Excludes officeworkers.
[2] Includes 215 men in placer assessment, exploration, development, or prospecting; 151 in lode.
[3] Includes sand and gravel and clay operations.

TABLE 5.—Employment at mines, by number of men employed

Type of operation	Number employed			
	1-9	10-19	20-29	30 and over[1]
Metal mines[2]	204	9	2	8
Nonmetal mines	77	2		
Quarries and mills	5			
Coal mines	2	2	4	2
Total	288	13	6	10

[1] Includes 2 operations employing 30-39; 5 operations, 40-49; 1 operation, 70-79; 2 over 100.
[2] Includes assessment, exploration, and development operations.

Employment.—Activity at 252 mines and 1 milling plant furnished employment for 1,733 men in 1959, compared with 276 mines, 1 milling plant, and 1,925 men in 1958. The decline in the number of mines and in men employed in 1959 was consistent with the reduced mineral output. There were also 64 prospector or purely investigational operations employing 246 men.

Wages and Hours.—Mines in Alaska operated an average of 154 days. The short working period resulted from climatic conditions, which in many instances made it necessary for men to work for 20 or more overtime hours per week at premium pay.

In mineral industries covered by the Employment Security Act (companies having at least four employees working not less than 20 weeks during the year) the average monthly earnings were $511; the average monthly wage in metal mining for the United States was about $430. The average hourly wage rates shown in table 4 were generally high in relation to the national metal-mining average of approximately $2.50. This disparity resulted from the necessity to earn enough funds for a full year during a short working season and from the high cost of living. The Civil Service Commission annual survey indicated that the cost of living in Anchorage, Fairbanks, and Juneau was 48, 52, and 33 percent higher, respectively, than in Washington, D.C.

TABLE 6.—Average wage rates paid by coal and metal mining companies, by occupation

Occupation	Coal mines		Metal mines	
	1958	1959	1958	1959
Cook	$3.51	$3.63	$2.50	$2.70
Drill operator	----------	4.08	3.90	4.10
Drill operator helper	----------	3.73	3.20	3.40
Laborer	3.31	3.63	2.90	3.10
Loading and machine operator	4.36	4.68	----------	----------
Miner	4.21	4.53	3.50	3.70
Shovel and dragline operator	4.21	4.53	4.00	4.20
Tractor operator	3.71	4.03	3.90	4.10
Truck driver	3.51	3.83	3.70	3.90

Injuries.—Two accidental deaths marred the record for 1959. A Mrak Coal Co. contractor was fatally injured when a tractor that he was operating at a strip coal mine rolled over a 65-foot bank. A Newmont Mining Co. geophysicist died of injuries received when a helicopter used for reconnaissance crashed on Gilman Glacier, Glacier Bay National Monument. Lost-time accidents continued to decline, decreasing from 112 in 1958 to 79.

Legislation and Government Programs.—One of the major government actions affecting Alaska in 1959 was the Presidential Proclamation admitting the former Territory into the Union as of January 3. The provisions of the Statehood Act bearing on the mineral industry were covered in the 1938 Minerals Yearbook.[5] The Statehood Act was modified in 1959 to permit the new State to select (until January 3, 1964), as part of its 103,350,000-acre land grant, land placed under oil or gas lease after July 7, 1958. More than 15 million acres had been leased since July 7, 1958. Legislation on coal leases, raising the allowable maximum from 2,560 to 10,240 acres with an additional 5,120 acres possible at the discretion of the Secretary of the Interior, was enacted by the 86th Congress. The transition omnibus bill became law. The major provision of the bill authorized grants of $28.5 million to the State over a 5-year period. The sum of $10.5 million was appropriated for the 1960 fiscal year. The purpose of this bill was to provide transitional funds for activities assumed by the State that were performed by the Federal Government.

The first State Legislature convened in January 1959 and passed several laws affecting the mineral industry. Among those approved by the Governor was the State Organization Act; one of its provisions was the creation of a Department of Natural Resources, which was charged (among other things) with the functions of the former Department of Mines, Oil and Gas Commission, and Department of Lands. The Alaska State Land Act was also passed. This Act outlined procedures for leasing oil, gas, mineral, tidal and other lands within Alaska. Oil and gas lease holdings of any one group or individual were limited to 1 million acres, of which not more than 500,000 acres may be on tide and submerged lands and 500,000 acres on other than tide and submerged lands. Tide and submerged lands open for oil and gas exploration were to be leased on a competitive bid basis; upland areas might also be leased competitively at the discretion of the Commissioner of Natural Resources or if known to contain oil and gas deposits. Minimum size for tidelands leases was set at 5,760 acres; other competitive leases were offered in 640-acre units. Noncompetitive leases were offered in units to 2,560 acres. Royalty rate was set at 12½ percent; initial discoveries in new structures were to pay only 5 percent for the first 10 years.

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[5] Minerals Yearbook, 1958, vol. III, p.76.

A bill directing the Commissioner of Public Works to build access roads into mineralized areas was approved; an appropriation of $50,000 was subsequently passed. The new Fish and Game Code requires miners to cooperate with the Department of Fish and Game and to notify the Commissioner of that Department of all water-use plans.

Remaining Office of Minerals Exploration (OME) contracts were terminated during the year. OME was the successor to Defense Minerals Exploration Administration (DMEA). Alaska Mines and Minerals, Inc., Red Devil mercury mine, Kuskokwim River region, completed repayment from production royalties of its $160,000 loan. No amendments to old contracts were signed, nor were any new contracts let.

Transportation.—Published water-freight rates were unchanged, except for inclusion of all-risk insurance effective August 20, 1959; some shippers claimed this was equivalent to a 3-percent drop in rates. Pacific Coast-Alaska Freight Conference, however, filed for a 10-percent increase in waterborne freight rates early in December. Federal Maritime Board approved the increase, effective January 10, 1960, on an interim basis, pending a hearing later in the year. The Conference cited continued advances in costs, particularly the longshore wage increase in July, as justification for the rate increase sought. Rates had remained stable since the 15-percent increase granted in March 1958.

TABLE 7.—Carload freight rates (per hundred pounds) for selected commodities, Seattle to selected Alaskan cities

Commodity	Seattle to—							
	Seward		Anchorage		Fairbanks via Valdez		Fairbanks via Seward	
	1958	1959	1958	1959	1958	1959	1958	1959
Machinery	$1.45	[1] $1.45	$2.49	[1] $2.39	$3.97	[1] $3.97	$2.82	[1] $2.82
Explosives	3.92	[1] 3.92	5.64	[1] 5.64	[2] 8.90	[1 2] 8.90	7.05	[1] 7.05
Diesel oil	1.36	[1] 1.36	1.91	[1] 1.91	4.17	[1] 4.17	2.89	[1] 2.89
Ores and concentrates (Southbound only) [3]	.78	.78	1.18	1.18	2.75	2.75	1.53	1.53

[1] Effective August 20, 1959, these rates include all-risk insurance.
[2] Includes charges for transfer and handling at Valdez.
[3] Value not to exceed $60 per ton. Rate increases 25 percent for each additional $60 (or fraction) valuation.

Japanese shipping interests announced in November the establishment of service between Japan and Alaska. Three ships per month were to be dispatched to the Japanese-owned pulpmill at Sitka. These ships would be available for cargo haulage from Japan. Also, because of the low specific gravity of chemical pulp, planners anticipated that the shipowners would be seeking ballast cargo (possibly iron ore) for the return trip. The effect of this announcement on the mineral industry was not yet apparent, but it was anticipated that imports of Japanese cement and structural steel would increase. From July 1953 to September 1959 a total of 17 Japanese ships (primarily lumber cargo) had called at Alaskan ports.

In September, Alaska Freight Lines, Inc., announced the end of its Seattle-Alaska service. Dock- and freight-handling facilities at Seattle and Alaska ports were leased to other operators. Foss Tug and Barge took over towing and other maritime operations. At the same time, a new shipper, Alaska Northern Express, announced weekly barge and van service from the Puget Sound area to Alaska. Alaska Northern leased certain facilities from Alaska Freight Lines and expected to start service early in 1960.

Federal appropriations for road construction in the fiscal year ending June 30, 1960, which included the 1959 construction season, amounted to $13.8 million. National Forest highway funds and National Park Service road funds totaled $3.3 million. Funds available for roadbuilding from all sources, including State matching-funds, were $18.8 million. The Federal Government continued to administer the highway program, under contract with the State. Transfer to the State was scheduled for fiscal year 1961.

The Livengood-Eureka Highway, eventually to become a part of the Fairbanks to Nome Highway, was opened as far as Manley Hot Springs. The Hutlinana River was still crossed by fording, but a bridge was scheduled for construction in the 1960 season. The road was not kept open in winter months. In the Nome area, bridges across the Snake and Penny Rivers were completed. The Chena Slough (Fairbanks) bridge was dismantled and moved to Nome for erection across the Kuzitrin River. Other roadwork at Nome included grading on the Nome-Kougarok Highway, paving the Nome airport, paving from the airport to the City, and improving the Nome-Council Highway. Paving contracts were completed for some 60 miles of work on the Alaska, Steese, and Wasilla-Big Lake Highways. Grading contracts completed in fiscal 1959 included work on the Copper River, Kalifonsky Beach, Portage Glacier, and McKinley Park Highways. About 14 miles of the Taylor Highway was gravel surfaced.

Battelle Memorial Institute studied the economic potential of Northwest North America under a contract with the Alaska International Rail and Highway Commission. Based on the findings of this study and on other data the Commission was to make recommendations concerning the types and extent of transportation facilities needed to develop the economic potential of the Northwest area. The Commission, created by an Act of Congress, was directed to report by June 1961.

Work was started on the $8.2 million harbor on Cook Inlet for the city of Anchorage. Usable facilities were scheduled to be ready late in 1960; completion was due in mid-1961.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—No antimony ore was mined or shipped. Small stocks produced in previous years remained on hand at a few properties. Kloss and Davis at Sunset Cove, Tillicum Mining Co. at Ketchikan, and the Stampede mine in the Kantishna district reported only assessment work for the year.

Copper.—Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., continued exploration in the Ruby Creek area northwest of Shungnak. Fremont Mining Co. and Moneta Porcupine Mines, Ltd., explored properties in Southeastern Alaska. Totem Exploration Co. and MacLaren River Copper Corp. were not active.

Fifty-three tons of high-grade ore was shipped from the old Kennecott mine to the Tacoma smelter. The ore, recovered from ballast of the old tramline, contained copper and silver.

Gold.—Value of output from Alaska mines declined 4 percent from 1958. Substantial decreases in the yardage washed by dredges of the Yukon River and Seward Peninsula regions and in yardage handled by nonfloat operations were the principal cause of the lowered value. Dredges accounted for 82 percent of total value, nonfloat operations 16 percent, and hydraulic, small-scale hand and lode mining 2 percent.

Yardage washed by all methods dropped from 18.2 million in 1958 to 14.1 million in 1959. Of the 14.1 million yards washed, dredges accounted for 12.5 million, or 89 percent. Nonfloat operations washed 1.6 million yards, or 11 percent. Yardage of hydraulic and small-scale hand methods was only a fraction of 1 percent. Average value per yard washed by all methods increased from 35.9 cents to 44.5 cents; the increase in value per yard, however, was not enough to offset the decrease in yardage washed.

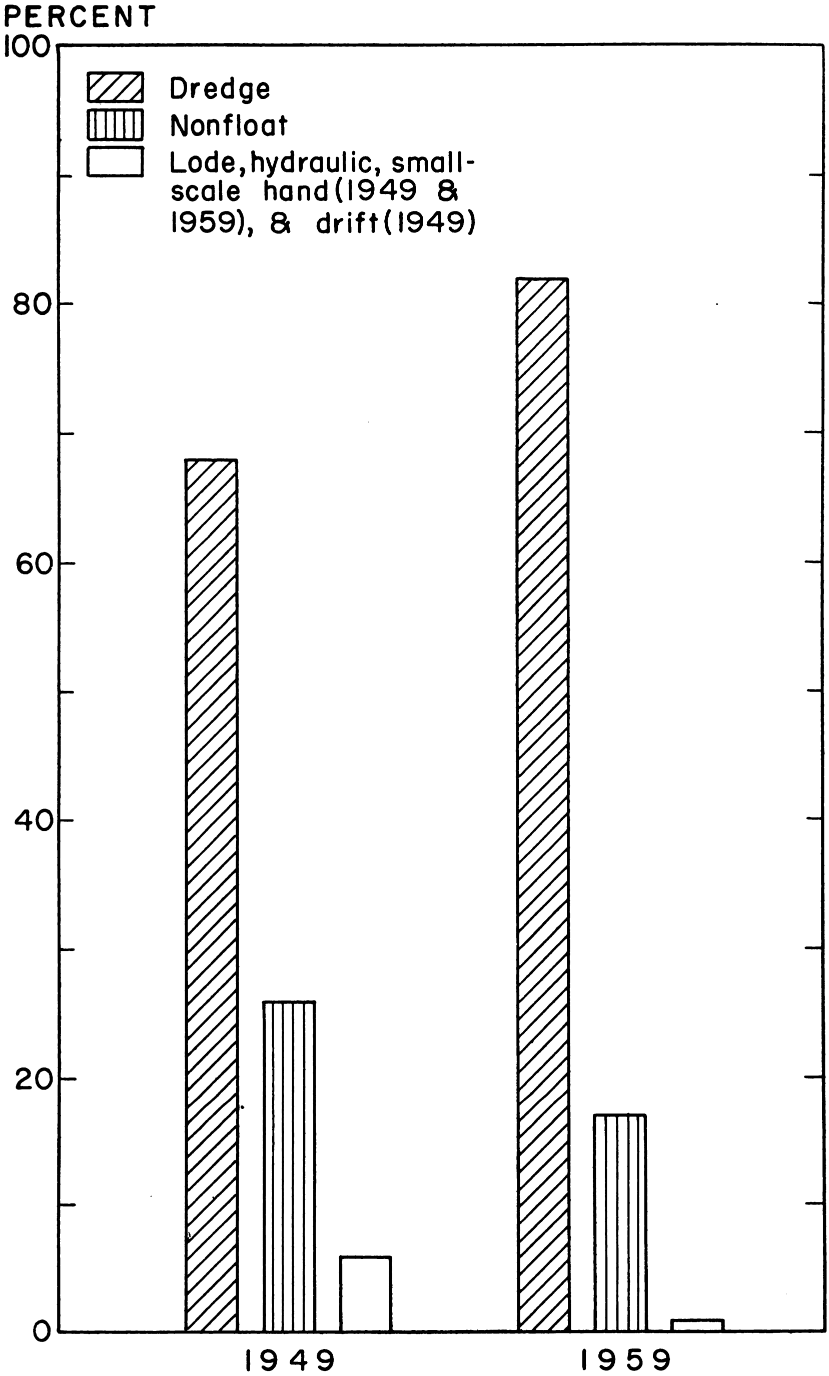

FIGURE 2.—Gold production in Alaska, 1949 and 1959, by method of mining.

TABLE 8.—Mine production of gold, silver, and other metals,[1] in terms of recoverable metals [2]

Year	Mines producing		Material sold or treated [3] (short tons)	Gold (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)
1950–54 (average)	6	154	20,844	254,352	$8,902
1955	4	142	3,884	249,294	8,725
1956	3	120	265	209,296	7,325
1957	4	87	11,626	215,467	7,541
1958	3	108	55	186,435	6,525
1959	2	94	617	178,918	6,262

Year	Silver (lode and placer)		Other		Total value (thousands)
	Troy ounces	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	37,512	$34	39	$11	$8,948
1955	33,693	31	2	1	8,757
1956	28,360	26	1	(4)	7,351
1957	28,862	26	9	3	7,570
1958	23,507	22	7	3	6,550
1959	21,358	19	36	22	6,303

[1] Includes copper, lead, and zinc produced.
[2] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes retreated, and ore shipped to smelters during calendar year indicated.
[3] Does not include gravel washed.
[4] Less than $1,000.

TABLE 9.—Fifteen leading gold-producing mines in 1959, in order of output

Rank	Mine	District	Region	Operator	Rank in 1958	Source of gold
1	Fairbanks Unit	Fairbanks	Yukon River	United States Smelting, Refining & Mining Co.	1	Dredge (6).
2	Nome Unit	Nome	Seward Peninsula.	do	2	Do. (3).
3	Hogatza River	Hughes	Yukon River	do	4	Do. (1).
4	Nyac	Aniak	Kuskokwim River.	New York-Alaska Gold Dredging Corp.	3	Do. (3).
5	Woodchopper Creek.	Circle	Yukon River	Alluvial Golds. Inc	5	Do. (1).
6	Candle Creek	Fairhaven	Seward Peninsula.	Far North Development Co.	(1)	Nonfloat.
7	Otter Creek	Iditarod	Yukon River	Otter Dredging Co	15	Dredge (1).
8	Inmachuk River.	Fairhaven	Seward Peninsula.	Inmachuk Mining Co	(1)	Do.
9	Long Creek	Ruby	Yukon River	Long Creek Mining Co	(1)	Nonfloat.
10	Colorado Creek	Innoko	do	Strandberg & Sons	6	Do. (1)
11	Redstone Mine (Livengood Cr.).	Tolovana	do	Redstone Mine	(1)	Do.
12	Eureka Creek	Hot Springs	do	Strandberg & Sons	9	Do.
13	Flat Creek	Iditarod	do	Flat Creek Placers	8	Do.
14	Prince Creek	do	do	Prince Creek Mining Co	(1)	Do.
15	Kougarok River	Kougarok	Seward Peninsula.	Lucky Syndicate	(1)	Dredge (1).

(1) Not among the 15 highest in 1958.

TABLE 10.—Gold produced at placer mines, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Washing plants	Material treated (thousand cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1950–54 (average)	15	24	13,321	197,022	$6,895,770	$0.518
1955	10	17	11,030	194,131	6,794,585	.616
1956	13	22	12,350	161,410	5,649,350	.457
1957	12	21	14,287	177,563	6,214,705	.435
1958	13	23	16,043	150,342	5,261,970	.328
1959	13	22	12,478	146,886	5,141,010	.412
Nonfloating washing plants: [2]						
1950–54 (average)	90	90	3,234	51,595	1,805,825	.558
1955	90	91	3,390	51,023	1,785,805	.527
1956	76	76	2,295	44,533	1,558,655	.679
1957	70	70	2,224	36,211	1,267,385	.570
1958	78	78	2,077	34,664	1,213,240	.584
1959	64	64	1,578	30,307	1,060,745	.672
Gravel hydraulically handled:						
1950–54 (average)	16	---------	95	1,571	54,992	.579
1955	15	---------	59	908	31,780	.540
1956	14	---------	24	866	30,310	1.258
1957	3	---------	116	974	34,090	.295
1958	9	---------	34	567	19,845	.587
1959	8	---------	25	522	18,270	.729
Small-scale hand methods (wet):						
1950–54 (average)	30	---------	20	813	28,441	1.422
1955	25	---------	35	898	31,430	.893
1956	17	---------	22	724	25,340	1.152
1957	2	---------	19	314	10,990	.575
1958	8	---------	14	662	23,170	1.657
1959	9	---------	11	585	20,475	1.895
Underground placers (drift):						
1950–54 (average)	2	---------	1	110	3,843	.549
1955	2	---------	(3)	42	1,470	3.675
1956–59	---------	---------	---------	---------	---------	---------
Grand total placers:						
1950–54 (average)	154	---------	16,670	251,111	8,788,781	.527
1955	142	---------	14,515	247,002	8,645,070	.596
1956	120	---------	14,692	207,533	7,263,655	.494
1957	87	---------	16,645	215,062	7,527,170	.452
1958	108	---------	18,168	186,235	6,518,225	.359
1959	94	---------	14,092	178,300	6,240,500	.443

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others, who gave no evidence of legal right to property.

[2] Includes all placer mines, using both power excavator and washing plant on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[3] Less than 1,000 cubic yards.

TABLE 11.—Mine production of gold and silver in 1959, by months, in terms of recoverable metals[1]

Month	Gold (troy ounces)	Silver (troy ounces)	Month	Gold (troy ounces)	Silver (troy ounces)
January	---------	---------	August	37,741	5,585
February	---------	---------	September	33,221	3,535
March	537	67	October	16,722	2,056
April	2,956	421	November	15,721	771
May	9,719	1,201	December	3,991	257
June	24,376	3,173			
July	33,934	4,292	Total	178,918	21,358

[1] Derived mostly from mint and smelter receipts; receipts from first part of 1959 are excluded because they were previously credited to 1958 production; expected receipts in 1960, part of actual 1959 output, are included.

TABLE 12.—Production of gold and silver at placer mines, 1959, by regions and districts

Region and district	Mines producing	Gold (troy ounces)	Silver (troy ounces)	Total value of production
Cook Inlet-Susitna:				
Valdez Creek	1	3	----------	$105
Yentna	4	263	41	9,242
Copper River:				
Nelchina	1	62	13	2,182
Kuskokwim River:				
Aniak	3	12,650	1,061	443,710
Seward Peninsula:				
Fairhaven	5	5,832	753	204,802
Kougarok	3	1,864	191	65,413
Koyuk	2	235	28	8,250
Nome	3	26,003	2,920	912,748
Port Clarence	2	94	13	3,302
Southeastern Alaska:				
Juneau	1	5	1	176
Yukon River:				
Circle	8	4,400	469	154,424
Fairbanks	9	87,109	11,041	3,058,808
Fortymile	9	1,625	310	57,156
Hot Springs	5	2,240	484	78,838
Iditarod	6	5,977	903	210,012
Innoko	10	4,537	422	159,177
Koyukuk	4	140	9	4,908
Melozitna	1	568	52	19,927
Rampart	4	460	33	16,130
Ruby	3	2,909	439	102,212
Other districts [1]	10	21,324	1,306	747,522
Total	94	178,300	20,489	6,259,044

[1] Includes 3 districts for which production was unreported by producer and following districts for which quantities and values cannot be shown separately: 1 each in Chistochina and Cape Yakataga, Copper River region; McGrath, Kuskokwim River region; Shungnak, Northwestern Alaska region; Council, Seward Peninsula region; Tolovana, and 2 each Chandalar and Hughes, Yukon River region.

Twenty-two dredges, one less than in 1958, were active during the year. United States Smelting, Refining and Mining Co. in the Yukon River and Seward Peninsula regions and New York-Alaska Gold Dredging Corp. in the Kuskokwim River region were again the leading producers. Yardage washed by dredges dropped from 16.0 million in 1958 to 12.5 million, a decrease of 22 percent. Average value per yard of ground washed increased from 32.8 cents to 41.1 cents. Total value of gold produced by dredges dropped 2.3 percent from 1958. The Pedro Creek dredge of United States Smelting, Refining and Mining Co. was moved to Chicken Creek in the Fortymile district, and gravel was being washed at the close of the season. Fairbanks Unit 2, sunk in a blasting accident in April, was repaired and put back into operation near the end of the season. Company Unit 5 at Nome was floated to a new digging location shortly before the season closed. New York-Alaska operated three dredges at Nyac, Aniak district, Kuskokwim River region.

The number of nonfloat operations (when gravel is delivered to washing plants by bulldozer or dragline) decreased to 64, compared with 78 for 1958; yardage washed declined 27 percent, and value of output dropped 16 percent. Value per yard washed, however, increased from 58 cents to 67 cents. The figures indicate that operators were forced to eliminate marginal ground and that marginal operators were squeezed by rising costs. The leading nonfloat producers were Far North Development Co. at Candle, Fairhaven district, on the Seward Peninsula, Long Creek Mining Co. at Ruby in the Yukon River region, and Strandberg and Sons in the Hot Springs, Hughes, and Innoko districts, Yukon River region.

TABLE 13.—Production of gold, silver, and other metals[1] at lode mines, in terms of recoverable metals

Year	Mines producing	Gold		Silver		Other		Total value (thousands)
		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	6	3,241	$113	3,567	$3	40	$12	$128
1955	4	2,292	80	526	(2)	2	1	81
1956	3	1,763	62	566	1	1	(2)	63
1957	4	405	14	1,836	2	9	3	19
1958	3	200	7	587	1	7	3	11
1959	2	618	22	869	1	36	22	45

[1] Includes copper, lead, and zinc.

[2] Less than $1,000.

As in the past, the Fairbanks district, Yukon River region, was the major gold-producing district in Alaska; the Nome district, Seward Peninsula region, was next in value of output. The United States Smelting, Refining and Mining Co. operated six dredges in the Fairbanks district, one at Chicken Creek, Fortymile district, and one on the Hogatza River, Hughes district, all in the Yukon River region; and two dredges in the Nome district. The Kuskokwim River region ranked third in value of output. New York-Alaska Gold Dredging Corp. at Nyac, operated three dredges.

Output from hydraulic and small-scale hand and lode mines was less than 2 percent of the total. Lode mining was virtually at a standstill. Except for a small quantity recovered by reworking old tailings in the Cook Inlet-Susitna region, the only lode gold produced was from the Arctic Alaska Fisheries and Enterprises, Inc., operation at the old Homestake property in the Fairbanks district. Some exploration and rehabilitation of properties was done in the Chandalar district.

Placer mine producers reported that 1,250 ounces of natural gold (nuggets, grains, and dust, not melted or amalgamated) was sold to buyers and jewelers, a decline of 450 ounces from the figure for 1958. Prices generally were $3 to $5 higher per ounce than the U.S. mint price of $35.

TABLE 14.—Equipment used at placer gold mines, 1959, by region

Region	Number of operations [1]	Gravel washed (thousand cubic yards) [2]	Equipment used (number)				
			Bulldozers	Draglines	Hydraulic giants	Dredges	Other [3]
Cook Inlet-Susitna	10	12	6		5		
Copper River	7	51	3		3		
Kuskokwim River	4	2,352	10	3	6	4	
Northwestern Alaska	2	4	1				
Seward Peninsula	25	3,019	22	4	19	7	8
Southeastern Alaska	2	(4)	2				
Yukon River	91	8,654	88	32	89	12	11
Total	141	14,092	132	39	122	23	19

[1] Includes equipment at 1 operation from which gold is a byproduct of platinum-group metals recovery, and at 47 operations which conducted assessment, development, and/or preparatory work but made no valuable mineral recovery.
[2] Partly estimated.
[3] Includes hydraulic elevators, power units, screen stackers, "dryland" dredges, and suction pumps.
[4] Less than 1,000 cu. yd.

Iron Ore.—Klukwan Iron Ore Corp. shipped magnetite concentrate from its Klukwan deposit (Southeastern Alaska) to the contiguous States for metallurgical testwork. Humble Oil & Refining Co. did some further work at the Dillingham prospect, Bristol Bay region. Interest in the iron deposits of Southeastern Alaska continued to be strong; 10 companies or individuals had active drilling, geological or geophysical projects.

Mercury.—Production of mercury increased 10 percent over 1958. Uninterrupted operation of the Red Devil deposit, Kuskokwim River region, accounted for the increase. The Schaefer mine in the Cinnabar Creek area, same region, was the only other producing deposit in Alaska.

Interest in Alaska mercury deposits dropped off in 1959. Only one of the major companies had a man in the field during the year. The Federal Bureau of Mines made a preliminary examination of a prospect at White Mountain, 60 miles southeast of McGrath, Kuskokwim River region. The prospect might have promise.

TABLE 15.—Production of mercury

Year	Number of producing mines	76-pound flasks	Price per flask [1]	Value
1950–54 (average) [2]	1	223	$189.58	$57,970
1955	1	(3)	290.35	(3)
1956	2	3,280	259.92	852,538
1957	2	5,461	246.98	1,348,758
1958	2	3,380	229.06	774,223
1959	2	3,743	227.48	851,458

[1] Value calculated at average New York price.
[2] No production 1950–51.
[3] Figure withheld to avoid disclosing individual company confidential data.

Nickel.—Activity in nickel deposits was largely confined to annual assessment work. One company reported drilling on a prospect at Glacier Bay, Southeastern Alaska region. Admiralty Alaska Gold Mining Co. continued its exploration activities at Funter Bay, Admiralty Island.

Platinum-Group Metals.—Goodnews Bay Mining Co., again the only primary producer of platinum in the United States, continued dredging operations 10 miles south of Platinum, Kuskokwim River Region.

Scrap Metals.—Shipments of scrap metal were 10,864 short tons valued at $167,399. Ferrous scrap went to Seattle, Wash. A small quantity of nonferrous scrap was exported to Japan.

Silver.—As in other years, most silver produced was a byproduct of gold mining. Ninety-six percent of the silver was obtained from placer mines, and 4 percent from lode mines, compared with 98 percent from placer and 2 percent from lode in 1958. Production of silver was 12 percent under 1958 because of declining gold recovery. Major gold producers were also leading silver producers. United States Smelting, Refining and Mining Co., the principal gold and silver producer, recovered silver as a byproduct of gold dredging in the Fairbanks, Hughes and Fortymile districts, Yukon River region, and in the Nome district, Seward Peninsula region. Silver was recovered from copper ore mined in previous years at the Kennecott mine, Copper River region, and from gold ore mined in the Fairbanks district.

Tungsten.—No tungsten ore or concentrate was shipped. Alaska Metals Mining Co., Yukon River region, Hyder Mines, Inc., Southeastern Alaska region and Kodiak Exploration Co., Kodiak region, reported surface exploration work. Kodiak Exploration Co. sent out small samples for milling tests. The company reported the samples assayed 4 to 7 percent WO_3.

Uranium Ore.—JOTT Mining Co. leased the Ross-Adams property on Bokan Mountain, Prince of Wales Island, Southeastern Alaska region. At yearend, the company was preparing to ship ore to the Lakeview Mining Co. plant at Lakeview, Oreg. Much of the ore produced by the Kendrick Bay Mining Co. in 1957 from the same property was not withdrawn from stockpile until 1959; therefore it was considered as 1959 output for statistical purposes. The U.S. Army Corps of Engineers began constructing a 2,000-kw. nuclear powerplant at Fort Greely, Yukon River region. This was the first such unit in Alaska.

MINERAL FUELS

Coal.—Tonnage of coal yielded by Alaska mines declined 13 percent from 1958; value declined 15 percent. The lower output resulted from large stockpiles remaining after recent warm winters and from the use by military agencies of pre-Korean War coal stocks. Most of these stockpiles were distant from the powerhouses, and it was anticipated that the military authorities would not replace them. Underground mining absorbed almost all decline; output dropped 42 percent compared with 1958. Output from strip mines declined only 3 percent. The computed average annual temperature at Anchorage and Fairbanks (the chief coal-consuming areas) was 29.8° F. compared with 32.0° F. for 1958.

TABLE 16.—Production of coal, by fields

(In thousands)

Year	Field						Total	
	Matanuska		Nenana		Barrow			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955	258	$3,055	381	$2,690	1	$14	640	$5,759
1956	269	3,273	457	3,055	1	46	727	6,374
1957	237	2,947	604	4,337	1	12	842	7,296
1958	290	3,532	468	3,392	1	7	759	6,931
1959	251	2,977	409	2,892	----------	----------	660	5,869

An estimated 69 percent of Alaska coal production was sold for heat and power at Ladd and Eielson Air Force Bases near Fairbanks and Fort Richardson, and Elmendorf Air Force Base near Anchorage, and other military bases in the State. Additional quantities of coal were sold to local utility companies to produce heat and power and to others for domestic heating and cooking. Retail prices at Anchorage were $22.75 per ton for steam sizes and $24.70 for nut, delivered. Coal pocket prices (retail) in Fairbanks were $13.85 per ton for chestnut and stoker sizes, $14.85 for lump, and $5.00 for screenings. An additional $4.00 was charged for drayage for the first ton, plus $3.30 for each additional ton.

Two underground and six strip mines (excluding three producers whose combined output was less than 1,000 tons) were active, compared with four and seven, respectively, in 1958. Castle Mountain Coal Co., active in 1958, had only minor production in 1959. Coal output continued to come from the Matanuska field, Cook Inlet-Susitna region, and the Nenana field (or Healy River), Yukon River region; there was very little production from the Barrow field. Strip mines produced 82 percent of total output, and underground mines 18 percent, compared with 73 and 27 percent, respectively, for 1958. The stripping ratio rose to 7.2:1.0 from 5.3:1.0 (revised figure) in 1958. Overburden ranged from 20 to 98 feet in depth. Average value, at the mine, of all coal produced decreased from $9.13 a ton in 1958 to $8.89.

Of total coal production, 38 percent was cleaned, compared with 43 percent in 1958. The decrease is largely attributable to the smaller tonnage of underground coal washed (19,000 tons in 1959, 42,000 tons in 1958), and to closure of the Usibelli Coal Mines, Inc., washing plant. The Evan Jones underground mine (Matanuska field), closed in May and was on a maintenance basis only for the remainder of the year. The company was sold by the Lathrop Corp. (Anchorage) to Western Reneline Corp. (San Francisco) late in 1959.

Jewell Ridge Coal Co. of Tazewell, Va., continued investigating the Bering River coalfield, Copper River region. Work was confined to opening old workings and obtaining tonnage samples for testing.

Petroleum and Natural Gas.—Production of oil and gas reached a significant level in 1959. By yearend, Standard Oil Co. of California, operator of the Swanson River and Soldatna Creek units on the Kenai Peninsula, was investigating the feasibility of a petroleum pipeline from the Kenai fields to tidewater on Cook Inlet. Of the 3,000-barrel-per-day minimum productive capacity needed to justify the line, the company had developed almost 2,000 barrels per day. Six wells were spudded during 1959 in the Swanson River unit, resulting in three producers, two dry holes, and one drilling at yearend. On the last day of the year, Well 14–27 was spudded in the Soldatna Creek unit.

TABLE 17.—Acreage under oil lease[1]

(In thousands)

Year	Acres	Year	Acres
1954	1,833	1957	6,516
1955	2,519	1958	27,900
1956	2,815	1959	34,265

[1] Data from Bureau of Land Management and Geological Survey, U.S. Dept. of the Interior.

Sixteen wells were spudded in the State during the year, and five wells previously spudded were deepened. Of the 21, 4 were drilling at yearend, 3 were commercial gas wells, 3 producing oil wells, 4 under test or hydrofracing, and 7 were dry holes. Total footage drilled was 141,933.

Development contracts were approved by the Secretary of the Interior for tracts to Richfield Oil Corp. in the Katalla-Yakataga area; Union Oil Co. of California and Ohio Oil Co. in the Knik Arm area, Cook Inlet-Susitna region; General Petroleum Corp. in the Becharof-Egegik area, Bristol Bay region; and Pan American Petroleum Corp. in the Kuskokwim-Bethel Basin at Napatuk Creek.

After a public hearing in July on proposed rules and regulations for oil and gas leasing on State-owned lands, State regulations were adopted, effective September 14, 1959. Provision was made for both competitive bidding and noncompetitive leasing of lands. On December 10, the first sale of offshore leases was held. Tracts that had been nominated earlier by interested parties were offered on a competitive-bid basis. The State received more than $4 million for 32 tracts in the Cook Inlet and Wide Bay areas. Union Oil Co. of California and Ohio Oil Co. submitted the highest bid, a joint offer of slightly more than $1 million for a 2,026-acre tract south of the Kenai River. (The total successful joint bid was $2,542,615 for 10,936 acres.) The next closest bid on the same tract was $6,078. Phillips Petroleum Co., Standard Oil Co. of California with Richfield Oil Corp., Texaco, Inc., General Petroleum Corp. with Continental Oil Co., Pan American Petroleum Corp., and Shell Oil Co. were among other successful bidders.

The 10-company offshore cooperative geophysical survey in the Cook Inlet area was completed in May. Results were not announced.

Perhaps the most significant event of the year in petroleum and natural gas was the discovery by Union-Ohio of commercial gas in the Kalifonsky Beach area on the Kenai Peninsula. Three wells in the joint-venture Kenai unit tapped gas in commercial quantities between 3,000 and 6,000 feet. After completing the third well late in the year, Union-Ohio suspended further drilling. Company officials announced that potential production was enough to meet anticipated demand for several years. Anchorage Gas Corp. entered into a contract with Union-Ohio for the purchase of gas at the wellhead; later in the year, Anchorage voters approved a franchise to distribute gas in Anchorage and surrounding areas. The company planned a 65-mile, 12-inch line across Turnagain Arm from the Kenai field; terms of the franchise required service to be available by December 1961.

Natural-gas consumption increased in 1959, primarily because the Puget Sound and Drake powerplant supplying company and Arctic Research Laboratory power requirements at Barrow converted to natural gas, produced from the South Barrow field (Naval Petroleum Reserve No. 4). Diesel equipment formerly used was to be held on a standby basis.

In September the Secretary of the Interior announced that 9,000 acres of the buffer zone between the Gubic field and Naval Petroleum Reserve 4 would be opened for leasing. No date was set for the sale. Colorado Oil and Gas Corp., lessee on most of the Gubic structure, previously announced that a $40 million pipeline from the field to Fairbanks would be warranted with the release of the buffer zone and a contract with the military for sale of gas. Subsequent discovery of natural gas on the Kenai Peninsula provided an alternate source of supply. Fairbanks voters approved a franchise for distributing gas in Fairbanks and surrounding areas.

NONMETALS

Clays.—Basic Building Products, Inc., Anchorage, Cook Inlet-Susitna region completed a downdraft kiln started in 1958. The kiln was oil fired and had a capacity of 20,000 to 25,000 brick and a firing time of 6 days. Roman, regular, and firebrick, selling at 15 to 24 cents each, were produced from clays mined at Sheep Mountain.

Gem Stones.—Raw jade for sale to lapidaries and collectors was mined on Dahl Creek, Shungnak district, Northwestern Alaska region, by C. E. Stout. Shungnak Jade project continued to purchase jade produced on the Shunknak and Kobuk Rivers and on Dahl Creek from Eskimo claim owners. The project, operated by Eskimos under the sponsorship of the Indian Arts and Crafts Board, supervised cutting, processing, and polishing jade into shapes for jewelry and souvenirs. Other jade miners in the Shungnak district produced jade for domestic use and for export to Germany. Small quantities of mineral specimens, including petrified wood and garnet, were collected and sold to mineral dealers and hobbyists.

Sand and Gravel.—The tonnage of sand and gravel increased 38 percent, and its value increased 36 percent over the figures for 1958. The increases occurred despite a carpenter strike, which hampered construction activity for much of the season. Operations of the Bureau of Public Roads, chiefly in the Cook Inlet-Susitna and Kenai Peninsula regions, accounted in large part for the increases.

TABLE 18.—Sand and gravel sold or used by producers, by uses

(In thousands)

Use	1958		1959	
	Short tons	Value	Short tons	Value
Sand:				
Structural	94	$191	88	$283
Paving	219	569	378	908
Gravel:				
Structural	118	190	879	1,040
Paving	3,581	2,649	4,166	2,611
Railroad ballast	203	254	170	133
Other sand and gravel [1]	40	18	178	290
Total	4,255	3,871	5,859	5,265

[1] Includes (1958) fill and roofrock gravel and blast and engine sand; (1959) fill and "Other construction" sand, and "Other construction" gravel.

Average value per ton was 90 cents, compared with 91 cents in 1958. Of the output, 1.26 million tons (22 percent) with a value of $2.60 per ton was washed, compared with 390,000 million tons (9 percent) and $1.93 respectively, for 1958. Value of unwashed sand and gravel was 43 cents per ton (81 cents for 1958). Thus, the value comparison of 90 to 91 cents is a result of a chance balancing of fluctuating values rather than of stabilized pricing in the industry. Value of sand and gravel in Alaska varied greatly according to local operating conditions; one report from the Aleutian Islands region listed 7,797 tons at a value of $194,925 ($25 per ton). Eleven commercial producers and six Government agencies (or their contractors) produced sand and gravel, compared with eight commercial and six Government producers in 1958. Commercial producers included the Alaska Railroad, an agency of the U.S. Department of the Interior, which was considered as a commercial producer for comparability with data published for the other States.

The major producers of sand and gravel remained the Bureau of Public Roads, U.S. Department of Commerce, and the Corps of Engineers, Department of the Army. Sand and gravel produced by Government agencies or their contractors was 89 percent of the total output, compared with 87 percent in 1958.

TABLE 19.—Stone sold or used by producers, by uses

(In thousands)

Use	1958		1959	
	Short tons	Value	Short tons	Value
Crushed and broken:				
Riprap	324	$965	77	$85
Concrete and roadstone	291	1,100	12	292
Total	615	2,065	89	377

Stone.—Tonnage and value of stone output decreased 86 percent and 82 percent, respectively, from 1958. The decrease reflected reduced activity in harbor and flood-control work by the Corps of Engineers, Department of the Army. The entire stone output came from quarries operated by Government agencies or their contractors. The Alaska Railroad, owned and operated by the U.S. Government, was the only producer classified as commercial, permitting data for stone in Alaska to be comparable with that of the other States.

The major part of the output (78 percent) came from quarries of the Bureau of Public Roads for use as riprap.

REVIEW BY REGIONS

Regions and districts used in this report conform to the boundaries defined in a report[6] published in 1954.

As in past years, the Yukon River region was foremost in value of mineral production. The Cook Inlet-Susitna, Kuskowim River, and Southeastern Alaska regions were next in importance. There was no mineral production reported from the Alaska Peninsula or Bering Sea regions.

Alaska Peninsula.—Humble Oil and Refining Co. (with Shell Oil Co.) drilled 1,300 feet during the year on Bear Creek No. 1, northeast of Wide Bay, before plugging and abandoning the well at 14,375 feet.

Aleutian Islands.—Stone and sand and gravel were the only mineral commodities produced. Value of production increased 31 percent over 1958.

TABLE 20.—Value of mineral production in Alaska, by regions[1]

Region	1958 (thousands)	1959 (thousands)	Minerals produced in 1959 in order of value
Alaska Peninsula	(2)	------------	
Aleutian Islands	$430	$564	Stone, sand and gravel.
Bristol Bay	(2)	98	Sand and gravel, gold.
Cook Inlet-Susitna	4,418	5,084	Coal, sand and gravel, gold, stone, clay, silver.
Copper River	365	184	Sand and gravel, gold, copper, silver.
Kenai Peninsula	104	745	Sand and gravel, crude petroleum, natural gas.
Kodiak Island	1,143	44	Sand and gravel.
Kuskokwim River	1,824	1,994	Mercury, platinum-group metals, gold, silver, sand and gravel.
Northern Alaska	14	16	Natural gas.
Northwestern Alaska	31	19	Gem stones, gold, silver.
Seward Peninsula	1,396	1,231	Gold, sand and gravel, stone, silver.
Southeastern Alaska	1,966	1,928	Sand and gravel, uranium, stone, gem stones, gold, silver.
Yukon River	9,759	8,588	Gold, coal, sand and gravel, silver, gem stones.
Total	21,450	20,495	

[1] No mineral production from Bering Sea Region.
[2] Less than $1,000.

Bristol Bay.—Humble Oil and Refining Co. continued exploring the Humble Kemuk Mountain iron claims. General Petroleum Corp. plugged and abandoned Great Basins No. 1 well near Lake Becharof, at 11,080 feet. Great Basins No. 2, 14 miles from No. 1, was drilled to 8,865 feet, then plugged and abandoned. General Petroleum received a 5-year development contract covering 455,573 acres in the

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[6] Ransome, Alfred L., and Kerns, William H., Names and Definitions of Regions, Districts and Subdistricts in Alaska: Bureau of Mines Inf. Circ. 7676, 1954, 91 pp.

Bacharof-Egegik area from the Department of the Interior. Requirements included starting a well before December 31, 1959 and one well in each of the following years except the fifth.

Cook Inlet-Susitna.—The region ranked second in value of mineral production in the State. Coal and sand and gravel accounted for almost all of the $5.1 million value of production. Total value of other mineral commodities produced (gold, silver, stone, clay) was less than $20,000.

Value of coal production decreased 16 percent from 1958; tonnage decreased 13 percent. The average value per ton was $11.84, compared with $12.16 for 1958. Coal mined in the region came from the strip mines of Evan Jones Coal Co., Mrak Coal Co., and Pioneer Mining Co., Inc., and from the underground mine of Evan Jones. The Evan Jones underground mine was shut down early in the year, and output of underground coal dropped 56 percent. Pioneer Mining Co., Inc., installed a secondhand jig-washing plant during the year. All coal production for the region was from the Mantanuska field.

A report was published on mine fires at inactive coal mines,[7] including references to controlling the fire at Premier No. 5, Moose Creek. The Alaska work was done in 1954. A report on the Beluga River coalfield [8] was placed on open file. Six diamond-drill holes, ranging from 93 to 252 feet deep, and totaling 1,085 feet, were drilled to explore a coal seam outcropping 4 miles northeast of Beluga Lake. Four of the holes cut the outcrop seam, one cut a 28-foot seam believed to underlie the outcrop seam, and one was blank. From the drilling, true thickness of the clean coal was estimated at 44 feet. Indicated reserve over a strike length of 1,600 feet and to an overburden depth of 171 feet was estimated at 1.6 million tons.

The pits of the Cook Inlet-Susitna region were again the chief producers of sand and gravel in Alaska. Six commercial producers and four Government agencies produced 2.2 million tons valued at $2.1 million. The Bureau of Public Roads was the leading producer both in tonnage and value.

Alaska Consolidated Oil Co., Inc., drilled the Zappa No. 1 at Iniskin Bay, spudded on Christmas Day 1958, to 11,200 feet. The company drilled 10,973 feet in 1959. In August Anchorage Gas and Oil Development Co., Inc., spudded Rosetta No. 4, 30 miles north of Anchorage. The well, drilled to 1,624 feet, was put under a drill-stem test in October; no results were released. Union Oil Co. of California and Ohio Oil Co. were awarded a development contract covering 229,000 acres in the Knik Arm area northwest of Anchorage. Three wells had to be drilled within 4 years.

Basic Building Products, Inc., completed constructing a 20,000 to 25,000 brick downdraft kiln at Anchorage. The company mined a small quantity of clay at Sheep Mountain in 1959. This was mixed with clay stocked at the plant and used to produce roman, regular, and firebrick; starting-up difficulties held production to a low level.

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[7] Jolley, T. R., and Russell, H. W., Control of Fires in Inactive Coal Deposits in Western United States, Including Alaska, 1948–58; Bureau of Mines Inf. Circ. 7932, 1959, 22 pp.

[8] Warfield, R. S., Summary of Core Drilling Results, Beluga River Coal Field: Open-file report, Bureau of Mines, 1959.

Transfer of Alaska Railroad's interest in the Knik Arm thermal powerplant to Chugach Electric Association was approved by the Federal Government. Alaska Railroad had a 31-percent interest in the 14,500-kw. plant on Ship Creek. Payment (about $2.3 million) was to be out of revenues from the sale of electricity and steam to the Alaska Railroad, Native Hospital Service, and other customers. The Bureau of Public Roads contracted for aerial photography, surveys, and mapping of a 140-mile segment of the proposed Anchorage-Fairbanks Highway via Broad Pass. The work completed the preliminary engineering study of the project.

Discovery of a molybdenum deposit in the Hayes River area west of Anchorage was reported. Examination work to evaluate the deposit was planned during the 1960 season.

Copper River.—Value of minerals produced in the region was less than 1 percent of the total for the State. Sand and gravel accounted for 67 percent of the value of output; gold, copper, and silver, the balance.

A development contract to Richfield Oil Corp. covering 571,000 acres (the balance of the acreage formerly held by Phillips Petroleum Corp. in the Katalla-Yakataga area) was approved by the Secretary of the Interior. Phillips drilled three wells before abandoning the area in 1957. Richfield had earlier received a contract on approximately one-half of the original Phillips holdings.

Richfield completed preparatory work and spudded Kaliakh Unit 1 near Yakataga, Yentna district; the well was drilling at 5,493 feet at yearend. It is about 50 miles from the nearest well drilled by Phillips and some 75 miles east of the old Katalla field, which produced 154,000 barrels of oil from shallow depths from 1903 to 1933. Setting-up costs, including 23 miles of road and bridges over the Duktoth and Kaliakh Rivers, were reported at $1.5 million.

Jewel Ridge Coal Co. of Tazewell, Va., continued exploratory work in the Bering River coalfield. Intense faulting and crushing present problems both in establishing reserves and in developing a feasible method of exploiting the coking coal. The field is 50 miles southeast of Cordova and 12 miles northeast of Katalla.

The Bureau of Public Roads produced 273,000 tons of sand and gravel valued at $123,000, a decrease of 39 percent in tonnage and 57 percent in value from 1958. No other production was recorded.

Kenai Peninsula.—Sand and gravel was the leading mineral commodity in terms of value, and crude petroleum was second. Interest, however, centered on developments in petroleum and natural gas.

Union-Ohio's discovery of commercial gas in Kenai Unit 14–6 and the development of additional producing wells by Standard Oil Co. of California (with Richfield Oil Corp.) in the Swanson River Unit highlighted activities in the region for 1959. Kenai Unit 14–6, spudded late in May, was drilled to 15,047 feet, a depth record for Alaska. While the well was being drilled at a depth of 4,232 feet and the drill crew was pulling out of the hole, the well blew out. Approximately 10 hours of countermeasures were required to control the well. Drilling was then resumed, but no petroleum was found. Company officials announced an indicated flow of 31 million cubic feet of gas per day (⅞-inch choke, 1,650 p.s.i.) from the 4,500-foot horizon. Kenai Unit 34–31, spudded in October, was drilled to 5,809 feet; flow reportedly was 17 million cubic feet per day (¾-inch choke, 1,250 p.s.i.) from 4,700 to 4,800 feet. Well 33–30, spudded in November and drilled to 5,011 feet, reportedly flowed at the rate of 15 million cubic feet per day (¾-inch choke, 800 p.s.i.) from the 4,250-foot horizon. Anchorage Gas Corp. contracted with Union-Ohio to take delivery of gas of 950 B.t.u. or higher at the wellhead for distribution in Anchorage and surrounding areas. Anchorage Gas was to handle gathering, dehydrating, and transportation to market. Initial pressures were thought to be high enough for transport without booster compressors, at least during the early life of the project. A 65-mile, double, 12-inch line across Turnagain Arm from the Kenai Peninsula was planned. Anchorage voters approved a distribution franchise to Anchorage Gas Corp. calling for service to be available by December 1961. Union-Ohio reportedly considered liquefying some of the gas to obtain additional markets. Shipment to the Orient also was being considered.

Standard Oil Co. of California, operator of the Swanson River Unit, added three producing oil wells to the two already producing at the beginning of the year. Total productive capacity at the end of the year was almost 2,000 barrels per day. Swanson River Unit 34–16, spudded in January, was drilled to 12,582 feet. It was plugged and abandoned as a dry hole; 14–15, drilled to 11,460 feet, had an initial flow of 100 barrels per day. Well 32–15, spudded in August and drilled to 11,982 feet, was reported flowing at 1,300 barrels per day from 11,400 feet. A third producing well, 12–27, came in at more than 400 barrels per day from 11,500 feet. The well, spudded in July and drilled to 11,500 feet, was reported as having indications of commercial gas at 7,600 feet. Wells 32–22 and 14–27 were drilling at yearend. Standard also spudded Soldatna Unit 41–4 on the last day of the year. Tentative plans for a 22-mile, 8-inch pipeline from the Kenai fields to Nikishka on Cook Inlet were being considered by Standard. The project, estimated to cost $4 million, included a wharf, storage capacity for 240,000 barrels, and other terminal facilities.

Halbouty Alaska Oil Co. and King Oil Co., Inc., spudded the Halbouty-King No. 1 about 5 miles southwest of Standard's Swanson River discovery well in January. The well, drilled to 12,037 feet, was plugged and abandoned in May.

A total of 11 wells were spudded in the region, and 100,602 feet of hole was drilled. Two wells were dry holes, three commercial gas wells, three producing oil wells, and three were drilling at yearend.

Sand and gravel produced was 969,000 tons valued at $450,000. The Bureau of Public Roads was credited with more than 99 percent, both on tonnage and value basis. There were no commercial producers of record.

The Corps of Engineers, U.S. Department of the Army, announced that a study was underway on the feasibility of a power project to be built on Bradley Lake northeast of Homer. The study was part of a survey of civic improvement projects in the Cook Inlet Basin. Initial investigation indicated some 23,000 kw. of low-cost prime power available from a basic development of Bradley lake drainage and substantial additions from auxiliary downstream sites.

Kodiak.—Minor quantities of sand and gravel constituted the entire mineral output of the region. All production was by the U.S. Navy.

Kuskokwim River.—The region ranked third in the State in value of mineral output. Mercury, platinum-group metals, and gold accounted for virtually all value. A small quantity of sand and gravel was produced.

Alaska Mines and Minerals, Inc. (formerly DeCoursey Mountain Mining Co.) operated the Red Devil mine on the Kuskokwin River, Aniak district, Georgetown subdistrict, throughout the year. The Red Devil was the major mercury producer in the State. Its production was more than 10 percent of the national total. Alaska Mines and Minerals continued developing the lower sections of the main Red Devil mine and explored the Rice series through the Rice shaft. On the 450 level of the Red Devil, the company sunk a 115-foot winze on the Mary Jane oreshoot and was preparing to mine the Girlie and B series veins below the 450 level. Recovery of mercury from condenser soot, always a major problem at Red Devil, was tremendously improved; cost was reduced by introducing a cyclone for batch treating the soot. Heated and conditioned pulp was cycloned at 40 p.s.i. in a closed circuit with an agitator. Cyclone underflow was mercury ready for cleaning and bottling; overflow after batching (about 2 percent mercury) was returned for furnacing. This successful use of a cyclone on what had been a very difficult soot-recovery problem may be an innovation in the industry.

Goodnews Bay Mining Co. again was the only primary producer of platinum in the United States. The company dredged platinum-group metals from placers in the Goodnews Bay district. A small quantity of gold was recovered as a byproduct.

New York-Alaska Gold Dredging Corp. continued placer operations at Nyac, Aniak district. The company had three dredges active in the 1959 season.

Pan American Petroleum Corp. received approval from the U.S. Department of the Interior for a 465,000-acre development contract in the Napatuk Creek area, Bethel district. The contract called for a minimum expenditure of $950,000 and drilling three wells, the first to be spudded before March 1, 1961. Bristol Bay Oil Co., Sunray Mid-Continent Oil Co., and Empire State Oil Co. held acreage in the Napatuk Creek area. Pan American confined 1959 work to core-hole drilling 1,200 feet of hole.

Northern Alaska.—A small quantity of coal (less than 1,000 tons) was produced at Meade River for consumption at Barrow. Gas wells on Naval Petroleum Reserve 4 supplied 132,222,000 cubic feet of natural gas, valued at $16,000 to Government agencies and to the Puget Sound and Drake powerplant at Barrow. Consumption rose 263 percent over 1958, primarily because the Puget Sound and Drake powerplant converted to natural gas.

A report, "Recoverable Petroleum Reserves in the Umiat Structure, Naval Petroleum Reserve No. 4, Alaska," by the Bureau of Mines, was placed in open file. The report estimates recoverable reserves of 122 million barrels of petroleum in the Umiat structure. A second report,[9] containing crude oil analysis of 20 samples from 5 areas on the Arctic slope, was published. Results of analyses shows that oils produced in the five areas vary greatly in physical characteristics and chemical composition.

Northwestern Alaska.—Gem stones and gold were the only mineral commodities produced. Value was minor—less than 0.1 percent of the total value of the State's mineral output.

Bear Creek Mining Co. (a subsidiary of Kennecott Copper Corp.) continued examination of copper deposits at Ruby Creek, Shungnak district, north of the Arctic Circle. The deposits were discovered in 1901 by placer miners. After some initial interest and exploration, the area laid dormant until 1948, when a radiometric anomaly was found. The showing proved to be localized in one or two spots, but exploration showed copper mineralization to be more widespread than previously supposed. Bear Creek began examining the area in 1957. Besides geological and geophysical work, 35 diamond-drill holes totaling more than 27,000 feet had been sunk to probe for copper.

Seward Peninsula.—Gold, as in past years, was the leading mineral commodity produced, enabling Seward Peninsula to retain fifth rank in value of production among the regions of the State. Sand and gravel, stone, and silver made up the remainder of the value of the region's mineral output; total value of the three was only $26,000.

In the Nome district, United States Smelting, Refining and Mining Co. operated dredge 6 on the submarine beach deposit. No. 5 was floated to a new location in naturally thawed ground late in the season. No. 1 was retired to be cannibalized for spare parts. Thawing operations at Nome ceased; dredging was scheduled to finish at the end of the 1961 season unless the economic factors affecting the gold-mining industry should change.

Nugget Mining Co. Inmachuk Mining Co., Lee Brothers Dredging Co., and Lucky Syndicate each operated a dredge in the region. Nugget Mining Co. was working bench gravels and old tailings in the Niukluk River, Council district. Inmachuk Mining dredged stream gravels on the Inmachuk River, Fairhaven district. Lucky Syndicate worked stream gravels on the Kougarok River, Kougarok district, and Lee Brothers worked stream gravels on the Solomon River, Nome district. Nonfloat plants were operated by Far North Development Co., Fairhaven district, N. B. Tweet & Sons, Kougarok district, and Patrick J. Bliss, Koyuk district, among others.

The Bureau of Mines issued three published reports and one open-file report on the tin resources of the region.[10]

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[9] McKinney, C. M., Garton, E. L., and Schwartz, F. G., Analyses of Some Crude Oils From Alaska: Bureau of Mines Inf. Circ. 5447, 1959, 22 pp.

[10] Mulligan, John J., Tin Placer and Lode Investigations, Ear Mountain Area, Seward Peninsula, Alaska; Bureau of Mines Rept. of Investigations 5493, 1959, 53 pp.

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Mulligan, John J., and Thorne, Robert L., Tin-Placer Sampling Methods and Results, Cape Mountain District, Seward Peninsula, Alaska: Bureau of Mines Inf. Circ. 7878, 1958, 69 pp.

Wells, R. R., and Sterling, F. T., Preliminary Concentration of Tin-Bearing Placer Tailing: Bureau of Mines Open-file rept., April 1959.

Southeastern Alaska.—The region ranked fourth in the State in value of mineral production. Sand and gravel, uranium, and stone were the leading mineral commodities. Value of total mineral production was essentially unchanged from 1958. Output of sand and gravel, 736,000 tons valued at $1.04 million, accounted for 54 percent of the value of minerals produced. The U.S. Army Corps of Engineers and the U.S. Bureau of Public Roads were the major producers. Commercial production of record, as opposed to production from Governmental agencies, was minor. Value of uranium credited to the region was from ores produced in past years and processed in 1959. Credits in accounting are made in the year of processing rather than when actually produced. Late in the season, JOTT Mining Co., Oklahoma City, Okla., took over the Bokan Mountain uranium deposit of Kendrick Bay Mining Co. on Prince of Wales Island. No ore was shipped in 1959.

Interest in the iron-ore deposits of the region continued to be strong. Nine companies or individuals conducted examination or exploration projects in 1959. Local newspapers reported that Klukwan Iron Ore Corp. (under option to Columbia Iron Mining Co.) shipped 5,000 tons of magnetite concentrate from its Klukwan deposit, 22 miles northwest of Haines, for metallurgical testing. The concentrate was produced in previous years.

Mt. Cloud Iron Co., Inc., conducted a drilling program on the Ptarmigan lode claims on the North Bradfield River. Preliminary drilling results did not appear favorable.

Mt. Andrew Mining Co. and Prince of Wales Mining Co. continued development activities at the Mt. Andrew and Poorman mines, and exploration at the Salt Chuck mine—all on Prince of Wales Island. These companies also conducted an airborne magnetometer survey and a geological and geophysical mapping program.

Moneta Porcupine Mines, Ltd., explored the Sundum Chief copper-zinc deposit on the west slope of Sundum Mountain, 45 miles southeast of Juneau. The company completed 5,394 feet of diamond drilling and 245 feet of trenching.

Other major companies active in 1959 were Columbia Iron Mining Co., Fremont Mining Co., and Owen Ore Co.

Colorado Oil and Gas Corp. deepened Yakutat No. 3 well to 10,700 feet (146 feet drilled in 1959) before plugging and abandoning it. The company reported a gas show but no oil.

Yukon River.—Mines of the Yukon River region supplied 42 percent of the mineral production of Alaska. Gold, coal, and sand and gravel were the leading mineral commodities. The value of gold produced declined 2 percent; that of coal 15 percent. Total value of mineral production for the region declined 12 percent because of the reduced output of coal. The value of sand and gravel increased 3 percent.

A report[11] was published on Alaskan placer mining methods and costs using hydraulic and mechanical excavation equipment with nonfloating washing plants. The report was the first study of certain types of placer mining operations in Alaska since a comprehensive bulletin[12] in 1927. History and production, operating factors including labor conditions and wage rates, cost figures, and specialized methods developed in the last 30 years were discussed. Well illustrated, the report showed modern equipment and techniques at work in the placer fields of the State.

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[11] Thomas, Bruce I., Cook, Donald J., Wolff, Ernest, and Kerns, William H., Placer Mining in Alaska: Bureau of Mines Inf. Circ. 7926, 1959, 34 pp.

There were 12 dredges digging gold in the region. United States Smelting, Refining, and Mining Co. was again the leading gold producer in the Yukon River region, as well as in the State. The company operated six dredges in the Fairbanks district; one at Hogatza River, Hughes district; and one at Chicken Creek, Fortymile district. The company's Pedro Creek dredge was moved by truck over the Alaska Highway from Fairbanks to Chicken Creek. The move started July 4, and dredging operations were underway at the close of the season. Others mining by dredge were Alluvial Golds, Inc., on Coal Creek, and JAK Mining Co. on Crooked Creek, Circle district; Otter Dredging Co. at Flat, Iditarod district; and Minalaska, Inc. at Ophir, Innoko district. Dredges accounted for 81 percent of the gold output of the region.

Output of nonfloat plants (dryland dredges) contributed 18 percent of the value of the region's gold production. Strandberg & Sons (Eureka and Black Creeks, Hotsprings district; Indian River, Hughes district; and Colorado Creek, Innoko district), Long Creek Mining Co. (Long Creek, Ruby district), Wolf Creek Mining Co. (Wolf and Fish Creeks, Fairbanks district), Redstone Mine (Livengood Creek, Tolovana district), and Flat Creek Placers (Flat Creek, Iditarod district) were among the leading nonfloat producers.

Gold lode mining in the region was at low ebb. The Little Squaw Mining Co. was active in the Chandalar district, and some drifting was reported on the Mikado and Little Squaw veins. Arctic Alaska Fisheries and Enterprises, Inc., worked a vein newly discovered by geochemical prospecting methods on the Homestake property, Fairbanks district. Ore was mined from surface cuts and milled at the Cleary Hill stampmill.

Three strip mines and one underground mine produced coal during the year. With the closing of the Evan Jones at Jonesville, Cook Inlet-Susitna region, early in the year, Suntrana Mining Co.'s Suntrana mine was the only active underground coal mine in Alaska (Meade River Coal Co. mined a small tonnage of coal at Meade River near Barrow). Arctic Coal Co., Cripple Creek Coal Co., and Usibelli Coal Mine, Inc., operated strip mines in the Healy River field.

Benedum and Associates, a joint venture of several independent oil companies, spudded Nulato Unit 1, Anvik district, about 14 miles from the Yukon River. The well was down 1,850 feet at yearend.

Chatanika Power Co., organized by Fairbanks business men, purchased the Davidson ditch from United States Smelting, Refining and Mining Co. The company installed a modern hydroelectric plant at the Chantanika siphon, using water under a 550-foot head. The plant went onstream in August at 1,600 to 1,700 kw. Power was sold to United States Smelting, Refining and Mining Co., for its Engineer Creek dredge, and to the City of Fairbanks; 6 months of operation (summer) was planned.

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[12] Wimmler, N. L., Placer Mining Methods and Costs in Alaska: Bureau of Mines Bulletin 259, 1927, 236 pp.

The U.S. Army Corps of Engineers began installing a nuclear powerplant (APPR-1) at Fort Greely near Big Delta. The unit will develop 2,000 kw., of which 1,700 will be net output, as well as a considerable quantity of steam for space heating. The plant is being built as a pilot unit to work out problems arising from operation in the arctic climate. Construction was considerably behind schedule at the end of the year because of a prolonged strike.

The Mineral Industry of Arizona

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Arizona Bureau of Mines.

By William H. Kerns,[1] Frank J. Kelly,[1] and D. H. Mullen[1]

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ARIZONA again accounted for one-half of the Nation's total copper output as copper supplied $264.2 million (81 percent) of the State's $326.8 million value of mineral production. Copper production declined 11 percent, because of the labor strike which closed several important mines the last 4 months of the year, but value of output increased slightly. Principally because of the increase, the total value of mineral output in the State advanced 4 percent. Output of metals (mainly copper; byproduct gold, silver,

TABLE 1.—Mineral production in Arizona[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate..........gross weight..	18	$10	....	....
Clays [2]..........thousand short tons..	119	179	120	$179
Coal..........do....	8	54	7	63
Copper (recoverable content of ores, etc.)..........	485,839	255,551	430,297	264,202
Gem stones..........	(3)	86	(3)	88
Gold (recoverable content of ores, etc.)...troy ounces..	142,979	5,004	124,627	4,362
Lead (recoverable content of ores, etc.)..........	11,890	2,782	9,999	2,300
Lime..........thousand short tons..	126	1,817	123	1,666
Manganese ore and concentrate (35 percent or more Mn) gross weight..	62,279	5,220	68,183	5,727
Manganiferous ore and concentrate (5 to 35 percent Mn) gross weight..	1,455	32	10,693	234
Mercury..........76-pound flasks..	53	12	(4)	(4)
Mica (scrap)..........	1,717	25	3,069	55
Molybdenum (content of concentrate) thousand pounds..	2,320	2,827	3,181	4,019
Pumice..........thousand short tons..	401	1,025	487	1,153
Sand and gravel..........do....	12,208	9,526	13,458	11,966
Silver (recoverable content of ores, etc.) thousand troy ounces..	4,685	4,240	3,898	3,528
Stone..........thousand short tons..	1,528	2,731	2,468	3,998
Uranium ore..........	257,756	7,049	253,390	6,309
Zinc (recoverable content of ores, etc.)..........	28,532	5,821	37,325	8,585
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite), feldspar, fluorspar (1958), gypsum, nitrogen compounds (1958), perlite, petroleum, pyrites, tungsten concentrate (1959), vanadium, and values indicated by footnote 5..........	....	11,734	....	9,837
Total Arizona [5]..........	....	314,520	....	326,888

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; value included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential date; value included with "Items that cannot be disclosed."
[5] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

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and molybdenum from copper mining; lead, zinc, manganese ore, and uranium ore) furnished 92 percent of the total value of mineral production, and output of nonmetals (primarily sand and gravel, cement, stone, lime, and pumice) and fuels (coal and petroleum) supplied the remaining 8 percent.

Employment and Injuries.—According to the Arizona Employment Security Commission, employment in copper mining (including the Kennecott Copper Corp. Hayden smelter) averaged 13,500 each month for the first 7 months of the year, dropped to 11,800 in August because of a labor strike at several of the major copper operations and averaged 6,800 each month for the last 4 months of the year as the strike continued. Employment in copper smelting (excluding the Kennecott Copper Corp. Hayden smelter) averaged 1,900 a month for the first 8 months of the year and 750 a month for the last 4 months. A report[2] on wage statistics and copper output in Arizona and U.S. copper mines was published.

As shown in table 2, average hourly earnings, average weekly hours, and average weekly earnings in copper mining increased substantially.

TABLE 2.—Employment data in mining and related industries[1]

[U.S. Department of Labor, Bureau of Labor Statistics and Unemployment Compensation Division, Arizona Employment Security Commission]

Industry	Annual average employment		Percent of total non-agricultural		Average hourly earnings		Average weekly hours		Average weekly earnings	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
Mining	[2] 15,900	13,400	[2] 5.6	4.4	(3)	(3)	(3)	(3)	(3)	(3)
Copper mining	[2] 13,600	11,000	4.8	3.6	$2.40	$2.53	39.76	42.82	[2] $95.40	$108.15
Other mining and quarrying	2,300	2,400	.8	.8	(3)	(3)	(3)	(3)	(3)	(3)
Manufacturing	[2] 41,400	46,100	[2] 14.6	15.2	[2] 2.30	2.41	40.43	40.70	[2] 92.92	98.09
Copper smelting	[4] 1,800	[5] 1,500	.6	.5	2.28	2.40	41.00	44.27	93.40	106.42
Other manufacturing	[2] 39,600	44,600	[2] 14.0	14.7	(3)	(3)	(3)	(3)	(3)	(3)
Contract construction	[2] 26,600	28,500	[2] 9.4	9.4	3.12	3.28	37.88	36.87	118.25	120.19
Other nonagricultural	[2] 199,800	215,100	[2] 70.4	71.0	(3)	(3)	(3)	(3)	(3)	(3)

[1] Proprietors, firm members, personnel of the Armed Forces, domestics, and other self-employed persons are excluded.
[2] Revised figure.
[3] Data not available.
[4] Excludes Kennecott Copper Corp. smelter at Ray and San Manuel Copper Co. smelter at San Manuel, which have been included with copper mining.
[5] Excludes Kennecott Copper Corp. smelter at Ray, which has been included with copper mining.

The State mine inspector reported[3] nine fatal injuries in underground metal mines and four in open-pit operations for the year ending November 30, 1959. Seven of the fatalities in underground mines were caused by falling rock, one by a sloughing muck pile, and one by electricity. Two fatal injuries in open pits were caused by machinery, one by a premature blast, and one by haulage equipment. In addition, in 158 underground and 42 open-pit accidents injured employees lost 14 days or more.

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[2] Arizona Department of Mineral Resources, Wage Statistics and Copper Output—Arizona and United States Copper Mines—Base Period (1947–49) Compared With 1957–59 Period: 1959, 10 pp.

[3] Hershey, R. V. (Roy), Forty-Eighth Annual Report of the State Mine Inspector for the Year Ending Nov. 30, 1959: 1959, 28 pp.

Legislation and Government Programs.—The Office of Minerals Exploration (OME) executed no contracts in Arizona. The closing of the Government domestic asbestos purchase program at yearend 1958 adversely affected the asbestos industry throughout 1959. In October an announcement was made by the Office of Civil and Defense Mobilization that a limited quantity of chrysotile asbestos produced from domestic deposits would be purchased for the national stockpile. No asbestos was delivered under this program in 1959. Arizona's manganese industry came to a near standstill when the quota was reached and the Government carlot purchase program for the national stockpile was halted on August 5.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—No production of beryl was reported.

Copper.—Arizona retained its position—held since 1910—as the leading copper-producing State and accounted for one-half of the U.S. copper output. Production (430,297 tons) declined 11 percent (55,542 tons), but as a result of an increase in price the value of output ($264.2 million) advanced 3 percent ($8.7 million). Copper accounted for 88 percent of the total value of metal output ($300.1 million) and 81 percent of the total value of mineral production.

Production of copper was 47,000 tons in January, increased to a monthly high for the year of 51,000 tons in May, then fell to 29,000 tons in August because of the start of the prolonged strike. Monthly output fell to a low of 17,000 tons in September but rose to 18,000 tons in October and November and to 21,000 tons in December. The 5 leading copper producers furnished 67 percent of the total output, and the top 15 producers supplied 99 percent.

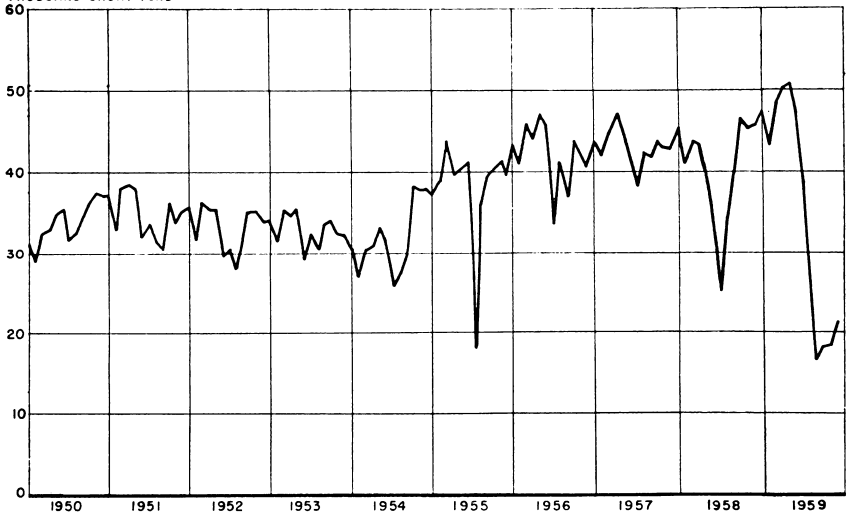

FIGURE 1.—Mine production of copper in Arizona, 1950–59, by months, in terms of recoverable metal.

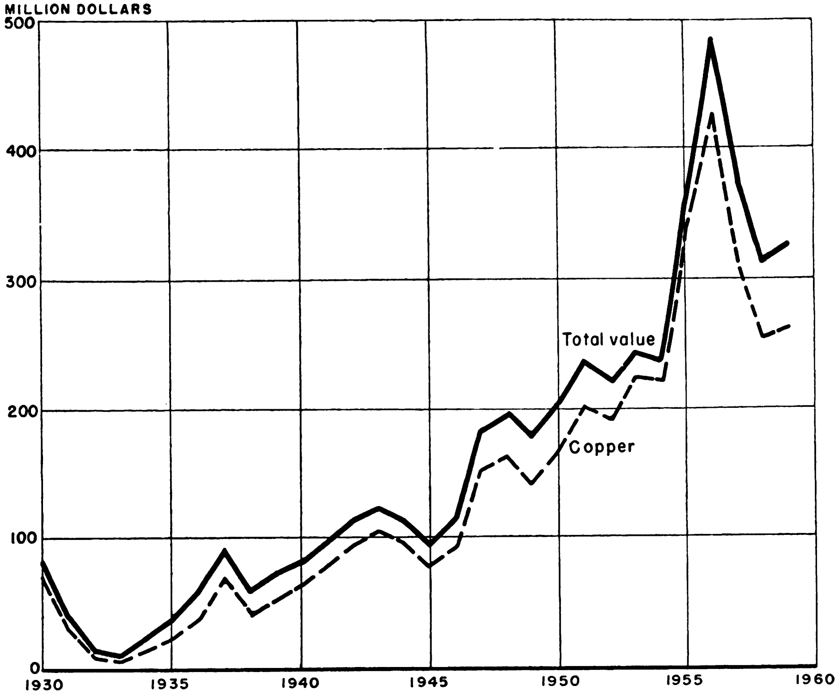

FIGURE 2.—Value of mine production of copper and total value of mineral production in Arizona, 1930–59.

TABLE 3.—Leading copper-producing mines in 1959, in order of output

Rank in 1959	Rank in 1958	Mine	District	County	Operator	Source of copper in 1959
1	1	Morenci	Copper Mountain.	Greenlee	Phelps Dodge Corp.	Gold-silver ore, copper ore, copper precipitates.
2	4	New Cornelia	Ajo	Pima	do	Gold tailings, gold-silver ore, copper ore.
3	2	San Manuel	Old Hat	Pinal	San Manuel Copper Corp.	Copper ore.
4	6	Inspiration	Globe-Miami	Gila	Inspiration Consolidated Copper Co.	Copper ore, copper precipitates.
5	3	Lavender pit Copper Queen.	Warren	Cochise	Phelps Dodge Corp.	Do.
6	5	Ray pit	Mineral Creek	Pinal	Kennecott Copper Corp.	Do.
7	9	Copper Cities	Globe-Miami	Gila	Miami Copper Co. Copper Cities Division.	Copper ore.
8	7	Silver Bell Unit.	Silver Bell	Pima	American Smelting and Refining Co.	Do.
9	------	Esperanza	Pima	do	Duval Sulphur & Potash Co.	Do.
10	10	Pima	do	do	Pima Mining Co	Do.
11	8	Magma	Pioneer	Pinal	Magma Copper Co	Do.
12	12	Bagdad	Eureka	Yavapai	Bagdad Copper Corp.	Do.
13	11	Miami	Globe-Miami	Gila	Miami Copper Co. Miami Copper Division.	Copper ore, copper precipitates.
14	14	Castle Dome dump.	do	do	Miami Copper Co. Castle Dome Division.	Copper precipitates.
15	13	Daisy-Mineral Hill.	Pima	Pima	Banner Mining Co	Copper ore.

TABLE 4.—Ore mined, waste and leach material removed, and total copper production at principal copper open-pit and underground mines, in short tons [1]

Mine	Ore mined		Waste and leach material removed		Total copper produced from all sources [2]	
	1958	1959	1958	1959	1958	1959
Open pit:						
Morenci	13,039,187	10,513,000	26,899,850	18,930,000	96,588	74,997
New Cornelia	7,711,440	9,823,000	13,691,784	15,060,000	54,929	70,949
Inspiration	4,621,091	5,378,848	5,462,587	3,993,262	41,821	47,012
Ray	4,311,334	2,998,888	[3] 9,912,120	[3] 7,419,324	42,932	29,084
Lavender	4,027,522	3,170,000	4,423,439	4,773,000	34,452	25,551
Copper Cities	2,768,390	3,060,575	2,103,269	[3] 1,809,488	18,036	18,470
Silver Bell [3]	2,748,600	2,776,400	3,342,060	1,602,610	(4)	(4)
Esperanza [3]	----------	[5] 3,216,383	4,917,331	6,545,400	----------	(4)
Pima	1,098,742	1,200,606	[3] [6] 3,120,835	[3] [6] 2,618,804	(4)	(4)
Bagdad	[3] 1,663,614	[3] 1,770,138	[3] 6,343,233	[3] 6,440,208	[7] 12,232	[7] 11,975
Castle Dome dump	----------	----------	----------	----------	[8] 2,632	[8] 2,451
Mission [3]	----------	----------	----------	1,654,650	----------	----------
Underground:						
San Manuel	11,486,300	7,595,867	----------	----------	74,701	(4)
Copper Queen	499,257	373,395	----------	----------	29,265	19,556
Magma	391,084	276,387	----------	----------	20,651	13,009
Miami	1,870,865	[9] 998,568	----------	----------	12,700	10,615
Daisy-Mineral Hill	121,990	83,322	----------	----------	[7] 3,548	[7] 2,281

[1] Source: Company-published annual reports except where otherwise specified.
[2] Includes copper recovered from leaching of material in place and in dumps.
[3] Source: Mining World Catalogue and Directory Number, Apr. 25, 1960, p. 102.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Wet weight.
[6] Cubic yards.
[7] Gross metal in concentrate shipped.
[8] Water leaching of mine dumps only.
[9] Cessation of underground mining July 1, 1959, and conversion to in-place leaching.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950-54 (average)	218	12	44,216	114,878	$4,021	4,760	$4,308
1955	173	7	52,710	127,616	4,467	4,634	4,194
1956	194	5	61,044	146,110	5,114	5,179	4,687
1957	141	8	60,166	152,449	5,336	5,279	4,778
1958	100	4	56,773	142,979	5,004	4,685	4,240
1959	101	3	53,732	124,627	4,362	3,898	3,528
1860-1959	--------	----------	(3)	12,450,674	323,269	354,539	273,243

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950-54 (average)	397,268	$201,888	15,622	$4,646	41,923	$12,617	$227,480
1955	454,105	338,762	9,817	2,925	22,684	5,580	355,928
1956	505,908	430,022	11,999	3,768	25,580	7,009	450,600
1957	515,854	310,544	12,441	3,558	33,905	7,866	332,082
1958	485,839	255,551	11,890	2,782	28,532	5,821	273,398
1959	430,297	264,202	9,999	2,300	37,325	8,585	282,977
1860-1959	16,656,786	6,375,865	600,346	116,462	814,889	196,559	7,285,398

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Data not available.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing[1]		Material sold or treated[2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Cochise	6	----------	3,573,484	32,662	$1,143,170	534,706	$483,936
Gila	19	----------	9,501,961	1,491	52,185	146,191	132,310
Graham	2	----------	59	1	35	63	57
Greenlee	1	----------	10,513,023	4,899	171,465	380,393	344,275
Maricopa	4	----------	1,755	1	35	2,248	2,035
Mohave	5	----------	2,171	30	1,050	18,107	16,388
Navajo	----------	----------	(3)	1	35	2,596	2,350
Pima	20	----------	17,059,276	37,182	1,301,370	1,031,250	933,333
Pinal	13	1	10,873,242	20,638	722,330	646,215	584,857
Santa Cruz	10	----------	40,196	49	1,715	124,455	112,638
Yavapai	17	----------	2,166,460	27,532	963,620	1,011,914	915,833
Yuma	4	2	523	141	4,935	198	179
Total: 1959	101	3	53,732,150	124,627	4,361,945	3,898,336	3,528,191
1958	100	4	56,772,819	142,979	5,004,265	4,684,580	4,239,781

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Cochise	45,544	$27,964,231	10	$2,334	517	$118,887	$29,712,558
Gila	78,910	48,450,771	23	5,370	----------	----------	48,640,636
Graham	1	860	----------	----------	----------	----------	952
Greenlee	74,997	46,047,943	----------	----------	----------	----------	46,563,683
Maricopa	1	399	3	610	----------	----------	3,079
Mohave	3	1,688	93	21,321	7	1,518	41,965
Navajo	180	110,581	----------	----------	2	460	113,426
Pima	123,640	75,914,899	688	158,206	4,946	1,137,649	79,445,457
Pinal	91,420	56,131,696	48	11,052	4	932	57,450,867
Santa Cruz	145	88,907	1,807	415,610	2,214	509,197	1,128,067
Yavapai	15,443	9,482,278	7,327	1,685,267	29,635	6,816,107	19,863,105
Yuma	13	8,105	----------	----------	----------	----------	13,219
Total: 1959	430,297	264,202,358	9,999	2,299,770	37,325	8,584,750	282,977,014
1958	485,839	255,551,314	11,890	2,782,260	28,532	5,820,528	273,398,148

[1] Operations at miscellaneous cleanups not counted as a producing mine.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Byproduct of uranium ore.

The strike against a number of the major copper-producing mines extended from mid-August through December. It was invoked after the operating companies and the International Union of Mine, Mill, and Smelter Workers, the United Steelworkers of America, and other local unions failed to agree on new labor contracts to replace the Mine-Mill 1956 contract terminated June 30 and Steelworkers 1956 contract terminated July 31, 1959. Operations idled by this 20-week strike included the Copper Queen and Morenci branches of Phelps Dodge Corp., Ray Division of Kennecott Copper Corp., and Magma and San Manuel properties of Magma Copper Co. Other major copper mining and milling operations and customs shippers were forced to stockpile ore, concentrate at the mines and mills, or curtail or stop production because the strike affected the smelters to which they usually shipped.

Duval Sulphur & Potash Co. began to produce copper in March at its Esperanza open-pit copper mine and 12,000-ton-per-day mill in Pima County. Five million tons of overburden was removed by Isbell Construction Co., which held the waste stripping and mining contract, before ore production was begun.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	13	732	218	1,210	18,200		
Dry gold-silver	8	68,959	985	19,520	991,300		
Dry silver	17	57,247	3	12,153	1,050,100	12,800	9,200
Total	38	126,938	1,206	32,883	2,059,600	12,800	9,200
Copper	41	53,121,545	96,153	2,724,701	803,087,000	8,400	218,100
Copper-zinc	5	96,299	74	39,241	4,922,800	52,400	20,617,600
Lead	10	4,087	68	28,000	11,900	478,400	35,700
Lead-zinc	5	346,147	26,866	1,066,145	1,099,900	19,440,500	47,234,700
Zinc	1	16,139	27	1,757	163,200		6,528,600
Total	62	53,584,217	123,188	3,859,844	809,284,800	19,979,700	74,634,700
Other "lode" material:							
Gold mill cleanings		8	21	33	200		
Gold and silver tailings	2	20,018	98	1,665	111,900		
Copper smelter cleanings and cleanings		969	36	1,307	167,300	5,500	2,100
Copper precipitates	13	32,685			48,610,000		
Uranium ore			1	2,596	360,200		4,000
Total	15	53,680	156	5,601	49,249,600	5,500	6,100
Total "lode" material	101	53,764,835	124,550	3,898,328	860,594,000	19,998,000	74,650,000
Gravel (placer operations)	3		77	8			
Total, all sources	104	53,764,835	124,627	3,898,336	860,594,000	19,998,000	74,650,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation: Ore	7	3			
Cyanidation: Ore	4,253	33,366			
Total recoverable in bullion	4,260	33,369			
Concentration and smelting of concentrates: Ore [1]	96,243	3,353,435	[2] 776,068,200	18,214,700	74,142,800
Direct-smelting:					
Ore	23,892	508,519	35,636,400	1,777,800	505,100
Copper precipitates			48,610,000		
Smelter cleanings, etc	155	3,005	279,400	5,500	2,100
Total	24,047	511,524	84,525,800	1,783,300	507,200
Other: Leaching of copper ore			(3)		
Placer	77	8			
Grand total	124,627	3,898,336	860,594,000	19,998,000	74,650,000

[1] Includes uranium-ore concentrate.

[2] Includes copper recovered from leaching of ore at 1 operation that employs "dual process" treatment of leaching followed by flotation concentration; combined to avoid disclosing individual company confidential data.

[3] Copper recovered by leaching ore at one operation included with "Lode: Concentration and smelting of concentrates: Ore" as indicated in footnote 2.

During the first half of the year, American Smelting and Refining Co. completed a 5-year exploration program of surface drilling, underground drifting, crosscutting, and raising on its Mission Project property—formerly called East Pima—15 miles southwest of Tucson and adjoining Pima Copper Co. and Banner Mine Co. properties. Large samples taken from underground workings were tested in a pilot mill at the University of Arizona. At the July 28 meeting of the Board of Directors, an expenditure of $43.5 million was authorized to bring the property into production within 3 years. The company began developing the copper ore body as an open-pit mine by stripping 200 feet of gravel-wash overburden. By yearend a contract was let for constructing milling facilities, with a daily capacity of 15,000 tons of ore and an annual output of 45,000 tons of copper, and the general office building was completed and occupied.

Inspiration Consolidated Copper Co. reported that at the end of the year the McDonald shaft headframe at its Christmas mine, 12 miles north of Winkelman, was nearly completed. Shaft sinking equipment was being installed, pilot-plan testing of the ore continued, commitments had been made for ore hoisting and crushing machinery, the warehouse building was completed, and the mine changehouse and office were nearly ready for occupancy. Final plans for the flowsheet and design of the mill was nearing completion. The planned production rate for this mine—starting in 3 years—was 4,000 tons of ore daily or 36 million pounds of copper annually.

After 3 years of deep diamond drilling and geological and geophysical surveying by its exploration subsidiary (Bear Creek Mining Co.), Kennecott Copper Corp. announced that it was buying 120 mining claims northeast of Safford. It was reported that a large copper mineralized area was discovered by the extensive exploration program. The mineralization consisted of mixed copper oxides and sulfides. The grade was low compared with that at operating open-pit mines, but the tonnage could be very large.

Phelps Dodge Corp. also was attracted to the Safford area. The company located and optioned claims adjoining Kennecott's property to the north and started a drilling program; copper mineralization reportedly was found in one hole at a depth of 1,000 feet. American Metal Climax, Inc., also entered the district and optioned claims further north on Turtle Mountain, in the same area where Phelps Dodge had previously drilled several holes.

In June, Ray Mines Division, Kennecott Copper Corp., released details of the third phase of its $40-million expansion program. With the completion of new storage, transportation, and milling facilities early in 1960, the property will be able to produce 20,000 additional tons of copper annually, according to the company officials. The new leach-precipitation-flotation (L–P–F) facilities, sponge iron and sulfuric acid production plant, and smelter and expansion of the Ray open pot, all part of this $40 million expansion and modernization program at the Ray Mines Division, were described.[4]

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[4] Mining World, Ray Mines Closes Ore to Metal Cycle: Vol. 21, No. 1, January 1959, pp. 44–46.
Mining World, Three New Projects Tailor Metallurgy to Ore at Hayden: Vol. 21, No. 7, June 1959, pp. 30–39.
Huttl, John B., The New Hayden Smelter Prepares to Take Ore From an Expanded Ray Pit: Eng. and Min. Jour., vol. 160, No. 6, June 1959, pp. 97–107.
Last, A. W., L–P–F Process at the Ray Concentrator: Min. Cong. Jour., vol. 45, No. 10, October 1959, pp. 108–111.

Underground mining at the Miami mine, operated by the Miami Copper Division of Miami Copper Co., terminated on June 26 after 48 years of continuous activity. Extraction of the remaining recoverable copper in the mined-out areas and in the unmined low-grade ore area was to be accomplished by in-place leaching and precipitation. Part of the underground work in the past several years was devoted to breaking the low-grade ore and providing additional underground sump and pump capacity preparatory to in-place leaching. On the surface, new pumps and a pipeline network were added to handle an increase in the volume of leaching solution. It was announced that fewer pounds of copper would be produced annually from this operation but the per-pound cost would be lower. The company's water leaching of the old waste dumps at the Castle Dome Division and mining and milling at the Copper Cities Division continued at about the 1958 level.

The Phelps Dodge Corp. announced plans and started work on an estimated $5-million expansion program on the Lavender open-pit mine of its Copper Queen Branch. The pit was being enlarged to the southeast and eventually will be deepened beyond the limits planned when initial operations were begun in 1954. According to the company, the enlargement will increase the life of this open-pit mine by 7 years or more to a total operating life of about 15 years.

Bagdad Copper Corp. announced plans to construct a plant to produce sulfuric acid by burning sulfur. The sulfuric acid was to be used to leach copper from the company's oxide-ore stockpile. This plant and the facilities for handling the leach liquor and precipitating the copper from the solution will cost an estimated $2 million, and the company expects this addition will increase recovery to 40,000 pounds of copper per day.

In November Pima Mining Co. consumated a custom mining and milling agreement with the neighboring Banner Mining Co., under which Pima was to enlarge its pit to include an adjoining part of the Banner property and to mine and mill Banner's ore from this area.

Cyprus Mines Corp. resumed operations in January at the Old Dick mine near Bagdad after being inactive throughout 1958 and added a substantial quantity to the State's 1959 copper output.

Transarizona Resources, Inc., began stripping operations to develop its open-pit copper mine 28 miles south of Casa Grande. The Transarizona mill, utilizing the segregation process for treating oxidized and mixed oxide-sulfide copper ores (which uses heat and flotation to recover copper), will be the first commercial plant of this type in the United States. A report[5] of the research done on this process was published.

Gold.—Gold output declined 13 percent and directly reflected the decreased production of copper as 77 percent of the gold output was recovered from copper ore. Of the remainder, 22 percent came from lead and zinc and 1 percent from gold and silver ores.

Three mining operations, New Cornelia and Copper Queen branches of Phelps Dodge Corp. and Iron King Branch of Shattuck Denn Mining Corp. (in descending order of output), furnished 77 percent of the State's gold output. San Manuel (San Manuel Copper Corp.), Magma (Magma Copper Co.), and Morenci (Morenci Branch of Phelps Dodge Corp.) supplied 20 of the remaining 23 percent.

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[5] Rampacek, Carl, McKinney, W. A., and Waddleton, P. T., Treating Oxidized and Mixed Oxide-Sulfide Copper Ores by the Segregation Process: Bureau of Mines Rept. of Investigations 5501, 1959, 28 pp.

Iron.—Sinter (sponge iron) produced from pyrite by Ray and Magma at their sponge iron and sulfuric acid plant at Hayden was used by Ray Mines Division of Kennecott Copper Corp. in place of detinned cans to precipitate copper from solution in the leach-precipitation-flotation (L–P–F) process in the Ray concentrator.

Webb & Knapp, Inc., announced the formation of Webb & Knapp Strategic Corp. and the purchase of the town of Clarkdale and the abandoned United Verde property. A 500-ton-per-day steel plant, costing $15 million, was to be built at Clarkdale to recover iron and produce steel from the 30 million tons of copper slag from the Clarkdale copper smelter. The smelter was last operated in mid-1950 by Phelps Dodge Corp. The slag was reported to contain 33 percent iron, 0.5 percent copper, and 2 percent zinc. Copper and zinc also would be recovered from the slag. Zeckendorf Steel Co., a Webb & Knapp Strategic Corp. subsidiary, was formed to operate the property. Arizona Research Consultants, Inc., of Phoenix, conducted laboratory work and made economic studies of the project for the company. Two shipments of copper slag from the Clarkdale dump, totaling 950 tons, were made to the Strategic Materials Corp., Buffalo, N.Y., which developed the Strategic-Udy process for recovering iron, copper, and zinc from copper slag. The slag was used in a test in the pilot plant of Strategic Materials Corp., Niagara Falls, Ontario.

Southwestern Iron and Steel Industries, Inc., reported activity on its Omega iron-placer deposit northwest of Tucson, where it has installed a magnetic-separation pilot plant, but there was no record of any concentrate being marketed.

Lead.—Lead output (9,999 tons) declined 16 percent below the low level of 1958 (11,890 tons). Output in both years was far below the 5-year average for 1949–53 (20,659 tons). Because of a lower average price for the metal, the value of the 1959 production dropped 17 percent to $2.3 million. The Iron King mine (Yavapai County), operated by Shattuck Denn Mining Corp., was the principal lead producer with an output of 7,251 tons—73 percent of the State's total. Changes in the flotation-cyanide treatment of the ore at the Iron King mill were described.[6] Three other properties, Flux and Glove in Santa Cruz County and San Xavier in Pima County, supplied most of the remaining lead output.

Manganese Ore and Concentrate.—Production of manganese ore and concentrate, 35 percent or more manganese content, increased 9 percent, compared with 1958. All material was marketed under the carlot program administrated by the General Services Administration (GSA) for the Government. Under this program, the minimum acceptable manganese content of the material purchased was 40 percent. Production was reported from 82 mines in 9 counties. Yuma and Maricopa Counties were the largest producers, followed by Pinal, Mohave, and Pima. When the quota was reached on the carlot program on August 5, purchase of ore for the Government stockpile was halted, and Arizona's manganese industry came to a near standstill. Mohave Mining and Milling Co., the State's largest producer and operator of a manganese mill and sintering plant at Wickenburg, stopped all mining and milling activity August 5 and announced its decision to liquidate the company. Throughout the year, the company supplied domestic and Mexican manganiferous ore and concentrate to the Kaiser Steel Corp. plant at Fontana, Calif., under a 1958 contract. This ore, used by Kaiser in steelmaking, was supplied by Mohave from mines in at least seven counties. Specifications were that the ore contain 25 percent or more manganese, less than 20 percent silica, and less than 1 percent combined copper, lead, and zinc.

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[6] Mining World, Flotation-Cyanide Methods Overhauled at Iron King: Vol. 21, No. 11, October 1959, pp. 24–27.

Mercury.—Production of mercury declined, but more exploration and development activity was reported in the State's principal mercury-producing area in the Mazatzal Mountains in Gila and Maricopa Counties. Production was reported from five mines: Gold Creek (Grimes & Brunson), Mercuria (Mercuria Mining Co.), Rattlesnake (Gus Packard), Oneida (Oneida Mining Co.), and Pine Mountain (Bacon, Grimes, & Brunson).

Molybdenum.—Production of molybdenum, a byproduct of copper mining and milling at seven of the State's major copper operations increased 37 percent in quantity and 42 percent in value. This substantial advance resulted primarily from an additional producer, Esperanza (Duval Sulphur & Potash Co.), and increased production from a new producer in 1958, Inspiration (Inspiration Consolidated Copper Co.). The five other mines with molybdenum output were Miami, Morenci, Silver Bell, San Manuel, and Bagdad.

Silver.—Silver production declined 17 percent ($712,000) and directly reflected the decreased production of copper, because 70 percent of the silver was recovered as a byproduct of copper mining. The remainder came from ores of gold and silver and copper-lead-zinc ore. The Iron King, Copper Queen Branch (Copper Queen mine and Lavender pit), New Cornelia, Morenci, and Magma mines, listed in order of output, were the five leading silver producers and supplied 68 percent of the output.

Uranium.—Uranium-ore production from 66 operations declined 2 percent in quantity and 10 percent in value compared with 1958 when production was reported from 86 operations. The grade of ore also declined from 0.32 percent (6.4 pounds) to 0.30 percent (6.0 pounds) U_3O_8 per ton. Major production continued to come from Navajo, Apache, and Coconino Counties, with small quantities from Yavapai and Cochise Counties.

The Atomic Energy Commission estimated that the uranium-ore reserve on December 31, 1959, was 1.2 million tons averaging 0.35 percent (7.0 pounds per ton) U_3O_8 compared with an estimated 1.4 million tons averaging 0.34 percent (6.8 pounds per ton) U_3O_8, on December 31, 1958.

Vanadium.—Some uranium ores from the Carrizo Mountains in northeastern Apache County contain significant quantities of vanadium. These ores were processed at mills in southeastern Colorado, and the recovered vanadium was credited to the State of Arizona. The quantity recovered in 1959 declined 10 percent from 1958.

TABLE 9.—Mine production of uranium ore[1]

County	1958				1959			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Apache	30	112,364	650,045	$2,722,869	16	85,384	445,808	$1,846,018
Cochise	1	10	59	255	1	22	80	285
Coconino	46	[3] 69,222	[3] 510,260	[3] 2,233,778	37	53,956	406,261	1,755,640
Mohave	1	(3)	(3)	(3)	----------	----------	----------	----------
Navajo	6	75,434	484,405	2,075,600	11	[4] 114,028	[4] 661,260	[4] 2,707,429
Yavapai	2	726	3,875	16,471	1	(4)	(4)	(4)
Total	86	257,756	1,648,644	7,048,973	66	253,390	1,513,409	6,309,372

[1] Based on data supplied to the Bureau of Mines by AEC.

[2] F.o.b. mine value; base price, grade premiums, and exploration allowance.

[3] Production of Mohave County combined with that of Coconino County to avoid disclosing individual company confidential data.

[4] Production of Yavapai County combined with that of Navajo County to avoid disclosing individual company confidential data.

Zinc.—The Iron King mine, operated by Shattuck Denn Mining Corp., was again the principal zinc producer and supplied 20,069 (54 percent) of Arizona's output of 37,325 tons of zinc. The Old Dick mine was reopened by Cyprus Mines Corp. in January 1959, after a year of inactivity and operated throughout the year. It was the State's second largest zinc producer. Other major zinc-producing mines, in order of output, were Atlas, Flux, San Xavier, and Johnson Camp (Moore shaft). McFarland & Hullinger closed the San Xavier mine late in the year and leased the Johnson Camp mine from the Coronado Copper and Zinc Co. The ore from the Johnson Camp mine was treated in the Partnership San Xavier mill at Sahuarita. Banner Mining Co. concluded a lease and option agreement with the partnership for acquisition of the San Xavier mine and surface plant, but the mill was excluded.

NONMETALS

Asbestos.—Completion of the Government's domestic asbestos purchase program adversely affected this segment of the State's mineral industry. Production was virtually limited to shorts and filter fiber, whereas in previous years the bulk of the income came from sales of Grades 1, 2, and 3 to the Government purchase depot at Globe. Mine output from Gila County—the only active mining area—dropped 24 percent in quantity and 72 percent in value. The only companies reporting output were American Fiber Corp. (Rock House mines), Jaquays Mining Corp. (Regal and Chrysotile), Metate Asbestos Corp. (Lucky Seven), and Phillips Asbestos Mines (Phillips).

The Office of Civil and Defense Mobilization announced late in 1959 that it would purchase 500 tons of chrysotile asbestos from domestic sources. The material to be acquired included Grades 1, 2, and 3, conforming to National Stockpile Specifications P-3-R1. Details on the mechanics of the proposed purchases had not been made public by yearend.

Cement.—Despite the part-time operation of the new American Cement Corp. plant at Clarkdale, total shipments of cement declined

7 percent. The new plant, operated by Phoenix Cement Co. Division, was completed early in the second half of 1959. However, because of a construction strike at the Glen Canyon Dam project, the plant was operated on a reduced scale.

Clays.—Production of miscellaneous clay for making building brick and other heavy-clay products was about the same as in 1958. Shipments of bentonite from the Sanders area declined 58 percent in 1959, thereby causing a significant drop in the overall clay revenue received by the mineral industry. Brick plants in Maricopa and Pima Counties were the major consumers of the miscellaneous clay produced. The bentonite mined in 1959 was shipped to California.

Diatomite.—A small pilot plant designed to process diatomaceous earth was constructed at the Whitecliffs mine in Pinal County by American Diatom, Inc. A little diatomaceous earth was produced in 1959 for experimental purposes, but no commercial shipments were made.

Feldspar.—Mohave County continued to supply all of the feldspar produced. The Taylor mines, operated for International Minerals & Chemical Corp., were the principal producers. All feldspar produced in Arizona was shipped to the International mill at Kingman.

Fluorspar.—No fluorspar was mined in 1959.

Gem Stones.—The collection of gem or ornamental stones continued to interest numerous individuals, societies, and dealers. The estimated $88,000 value of the material collected in 1959 was based on reports received from people collecting and processing these materials. Most activity was reported from Yavapai and Gila Counties. Copper minerals and turquois were two of the more important gem stones collected in 1959.

Gypsum.—Production of crude gypsum increased 10 percent. Two mines were operated in Pinal County by Arizona Gypsum Corp. and Union Gypsum Co. Arizona Gypsum Corp. shipped its mine output to a cement manufacturer and agricultural consumers. Union Gypsum Co. used all its crude gypsum at its Phoenix wallboard plant. A smaller quantity of crude ore, produced by Verde Gypsum Co., was used in manufacturing cement.

Lime.—Despite a prolonged strike at copper operations (one of the principle consumers), output of quicklime and hydrated lime was 123,000 tons, only 2 percent below 1958. Limekilns were operated in five counties by Paul Lime Plant (Cochise County), Hoopes & Co. (Gila County), Phelps Dodge Corp. (Greenlee County), San Manuel Copper Corp. (Pinal County), and The Flintkote Co. (Yavapai County). Nearly all shipments went to Arizona consumers.

Mica.—The market for crude scrap mica, particularly in California, stimulated mine production, and output reached 3,000 tons. Buckeye Mica Co. mines, in Maricopa and Yuma Counties, supplied the bulk of the production. James C. Stewart Co. and Charleston Mines, Inc., operated the Charleston mine near Tombstone. A gougelike material was processed, and sericite mica was recovered and sold. The ore also contained some kaolin, pyrite, lead, and zinc.

Nitrogen Compounds.—Randall Mills Corp. did not recover any bat guano from its Bat Cave operation, 600 feet above the Colorado River in Grand Canyon. Sales of this nitrogen-bearing material were made from stock produced in 1958. The cable connecting the south rim of Grand Canyon with Bat Cave, on the north wall of the Canyon, was severed by a low-flying aircraft. The cable had not been replaced at the end of the year.

Perlite.—Increased production of crude perlite by Perlite Industries of Arizona, Inc., in Pinal County, and the beginning of mining operations by Harborlite Corp., in the same county, were the major reasons for a 29-percent gain in output in 1959. Perlite expanding plants were operated at Phoenix (Perlite Industries) and Tucson (Tucson Perlite, Inc). The bulk of the untreated perlite was sold crude. The expanded perlite was used in building plaster, loose fill insulation, and building-block manufacture.

Pumice.—Material classified as pumice consisted of volcanic cinder (scoria), and total output reached 487,000 tons—22 percent greater than in 1958. Scoria used as railroad ballast accounted for 57 percent of the total consumption and that used in concrete aggregate for 42 percent. Scoria used as a concrete admixture and for industrial road surfacing accounted for the remainder. The Atchison, Topeka and Santa Fe Railway Co. operated its Darling cinder pit in Coconino County and was the principal producer. Other operators were San Xavier Rock & Sand Co., in Cochise County; Harenberg Block Co., Inc., and Superlite Builders Supply Co., Coconino County; and Gila Cinder Co., Graham County. Arizona Precast Concrete Co. did not operate its Maricopa County mine. The development of the Winona scoria deposit continued during the year. The mining operation of Superlite Builders Supply Co. of Phoenix was described.[7]

Sand and Gravel.—Sand and gravel continued to rank as the second most important mineral product of the State; the output was valued at $12 million. Consumption rose to 13.5 million tons, a 10-percent increase over the 12.2 million tons reported in 1958. Commercial production rose 12 percent and resulted from an increase in the use of building sand and fill sand and gravel. Government-and-contractor output was 9 percent above 1958 because of a substantial increase in the quantity of paving sand consumed. A report[8] showed that Arizona ranked 20th in the Nation with 100 miles of construction underway on the Federal interstate highway system. Of all mileage completed on the 41,000-mile superhighway network, Arizona ranked 11th, with 219.8 miles.

Stone.—Production of various types of stone rose to 2.5 million tons valued at $4 million—a 62-percent increase in quantity and a 46-percent increase in value. Crushed limestone, used principally in making cement and lime, accounted for 55 percent of the total and was partly responsible for the overall gain in output. Production of crushed miscellaneous stone also gained substantially, particularly by Federal agencies which used 603,300 tons as riprap and roadstone. Production of crushed basalt, granite, and marble also increased. The quantity of crushed sandstone continued to decline to 221,000 tons. Sales of dimension sandstone decreased to nearly half the 1958 total.

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[7] Rock Products, Mining Scoria Here is a Snap: Vol. 62, No. 3, March 1959, p. 106.

[8] Bureau of Public Roads, Status of Federal-Aid Highway Programs, press release BPR 60-3, Jan. 23, 1960.

TABLE 10.—Production of sand and gravel in 1959, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Apache	1,387	$1,241	Navajo	102	$85
Cochise	768	444	Pima	1,833	1,879
Coconino	1,391	1,803	Pinal	1,260	897
Gila	280	219	Santa Cruz	1	2
Graham	194	137	Yavapai	962	662
Greenlee	52	79	Yuma	454	292
Maricopa	4,706	4,154			
Mohave	68	72	Total	13,458	11,966

TABLE 11.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Building	1,022	$1,204	1,325	$1,672
Paving	297	231	179	157
Engine	(1)	(1)	(1)	(1)
Fill	31	18	322	166
Other	26	14	27	17
Gravel:				
Building	1,381	1,335	1,197	1,454
Paving	1,443	1,098	1,200	1,309
Railroad ballast	(1)	(1)	(1)	(1)
Fill	330	150	674	336
Other	44	31	192	197
Total sand and gravel	4,574	4,081	5,116	5,308
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	-----	-----	1	3
Paving	604	379	1,226	839
Gravel:				
Building	-----	-----	2	3
Paving	7,030	5,066	7,113	5,813
Total sand and gravel	7,634	5,445	8,342	6,658
Grand total	12,208	9,526	13,458	11,966

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 12.—Production of stone in 1959, by counties

County	Short tons	Value	County	Short tons	Value
Apache	35,700	$37,500	Navajo	240,861	$252,479
Cochise	328,516	784,947	Pima	769,600	832,500
Coconino	17,879	150,808	Pinal	(1)	(1)
Gila	51,589	57,712	Yavapai	(1)	(1)
Graham	400	400	Other counties	409,333	728,326
Greenlee	(1)	(1)			
Maricopa	613,807	1,153,783	Total	2,467,685	3,998,455
Mohave	(1)	(1)			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 13.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955	38,901	$61,027			41	$820	1,005,890	$1,164,656
1956	90,899	135,102	640	$640	1,810	30,605	1,066,920	1,326,602
1957	(1)	(1)	800	800	1,700	29,500	1,138,200	1,504,000
1958	(1)	(1)	(1)	(1)	3,600	62,800	1,122,800	1,399,540
1959	87,968	58,762	(1)	(1)	(1)	(1)	1,345,200	1,678,900

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	356,882	$906,313	199,225	$195,750	1,600,939	$2,328,566
1956	367,760	934,070	95,000	47,500	1,623,029	2,474,519
1957	903,053	1,410,087	56,806	37,296	2,100,559	2,981,683
1958	322,747	1,194,746	78,831	73,483	1,527,978	2,730,569
1959	238,101	820,146	796,416	1,440,647	2,467,685	3,998,455

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

TABLE 14.—Stone sold or used by producers, by uses

Use	1958		1959	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction short tons	20,903	$306,034	13,229	$128,360
Rubble do	(1)	(1)	634	3,238
Architectural:				
Rough cubic feet	(1)	(1)	(1)	(1)
Approximate equivalent in short tons	(1)		(1)	
Dressed cubic feet	[2] 53,705	[2] 112,488	(1)	(1)
Approximate equivalent in short tons	4,028		(1)	
Flagging cubic feet	105,810	115,094	22,386	17,403
Approximate equivalent in short tons	7,936		1,681	
Other (quantity approximate in short tons)	1,280	8,530	1,857	81,345
Total dimension stone (quantities approximate, in short tons)	34,147	542,146	17,401	230,346
Crushed and broken stone:				
Riprap short tons			563,300	1,127,900
Metallurgical do	389,200	682,800	314,000	630,000
Concrete and roadstone do	97,231	107,873	400,668	420,362
Other do	[3] 1,007,400	[3] 1,397,750	[4] 1,172,316	[4] 1,589,847
Total crushed and broken stone	1,493,831	2,188,423	2,450,284	3,768,109
Grand total (quantities approximate, in short tons)	1,527,978	2,730,569	2,467,685	3,998,455

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes 10,666 cubic feet (800 short tons) mill blocks valued at $40,000.
[3] Includes cement, cleansers, lime, roof granules, and terrazzo.
[4] Includes cement, lime, abrasives, roof granules, pottery, porcelain, tile, terrazzo, agriculture and mineral food.

Sulfur and Pyrites.—Kennecott Copper Corp. continued to produce a pyrite slurry at its Hayden L-P-F (leach-precipitate-flotation) plant for use in manufacturing sulfuric acid. Magma Copper Co. shipped pyrite concentrate to Hayden to supplement the feed to the acid plant. Facilities to produce sulfuric acid also were operated at Benson by Apache Powder Co., at Chandler by Southwest Agrochemical Corp., and at Inspiration by Inspiration Consolidated Copper Co. Crude sulfur from Texas was used at the two last-named plants.

Vermiculite.—The Glendale plant of Ari-Zonolite Co. was the only exfoliated vermiculite operation in Arizona. Output was 39 percent above 1958, and the use pattern for the finished product in 1959 was the same as that in 1958. Crude ore from Montana continued to be the sole source of millfeed.

MINERAL FUELS

Coal.—Coal production from two mines, one each in Coconino and Navajo Counties, declined 12 percent. The value, however, increased 17 percent.

Petroleum and Natural Gas.—The year 1959 was probably the most significant in the history of oil and gas in Arizona. Twenty-seven wells, 25 exploratory and 2 development, were completed, compared with 19 in 1958. Two Apache County exploratory wells, one oil and the other gas, were listed as discoveries. The oil discovery, 8 miles south of the Boundary Butte field in Utah, produced 240 barrels a day from Mississippian formations at a depth of 5,566 to 5,589 feet. The gas well was 4 miles west of the Bita Peak field and flowed at a rate of 4 million cubic feet a day from the Hermose (Pennsylvanian) formation at a depth of 4,999 to 5,071 feet. Several exploratory wells were drilled in the Pinta Dome helium area. One successful development well, an extension of the East Boundary Butte field, was completed in Pennsylvanian formations and produced 104 barrels of oil and 774,000 cubic feet of gas a day.

The State legislature created a State Oil and Gas Conservation Commission. The commission established offices in Phoenix in September and had most of its technical staff at yearend.

Approval for the construction of a 10,000-barrel-a-day oil refinery in Yavapai County was given the Bishop Oil and Exploration Co. by the County Board of Supervisors. The plant, estimated to cost $19 million, was to be equipped with anti-air-pollution equipment.

REVIEW BY COUNTIES

Apache.—Output of uranium ore and byproduct vanadium from uranium-ore milling accounted for two-thirds of the $4.2 million value of mineral production in the county. The county was the second largest producer of uranium ore in the State. Most of the output came from operations by Vanadium Corp. of America at the AT–49–1–305 and Monument No. 2 mines and The Kerr-McGee Oil Industries, Inc., at the Mesa group mines. Nearly all of the ore was processed at plants at Durango and Grand Junction, Colo., and at Shiprock, N. Mex., where facilities were available for recovering vanadium as well as uranium. All vanadium-bearing uranium ore produced in the State came from the Carrizo Mountains.

Alba Mining Co., a Filtrol Corp. subsidiary, continued to mine nonswelling bentonite from the Sanders area and was the principal nonmetal operation. Highway contractors for the Federal Bureau of Indian Affairs and the State highway department produced 1 million tons of paving sand and gravel.

Petroleum output tripled. Of the 27 oil and gas wells completed in the State in 1959, 17 (including the 2 discoveries) were in Apache County. Drilling in 1959 totaled 64,163 feet.

TABLE 15.—Value of mineral production in Arizona, by counties

County	1958	1959	Minerals produced in 1959, in order of value
Apache	$4,324,954	$4,233,943	Uranium ore, sand and gravel, vanadium, clays, petroleum, stone, gem stones.
Cochise	38,065,293	31,963,199	Copper, gold, stone, lime, silver, sand and gravel, manganese ore and concentrate, zinc, pumice, mica (scrap), manganiferous ore and concentrate, lead, gem stones, uranium ore.
Coconino	4,394,124	4,884,107	Sand and gravel, uranium ore, pumice, stone, manganese ore and concentrate, coal.
Gila	43,124,640	50,239,827	Copper, molybdenum, asbestos, sand and gravel, manganese ore and concentrate, lime, silver, stone, gold, gem stones, manganiferous ore and concentrate, lead, mercury, clays.
Graham	20,402	153,582	Sand and gravel, pumice, copper, stone, gem stones, silver, gold.
Greenlee	53,073,897	48,084,455	Copper, molybdenum, silver, gold, lime, stone, sand and gravel, gem stones.
Maricopa	5,370,894	6,698,542	Sand and gravel, manganese ore and concentrate, stone, clays, manganiferous ore and concentrate, mica (scrap), mercury, gem stones, silver, lead, copper, gold.
Mohave	950,678	982,759	Manganese ore and concentrate, stone, manganiferous ore and concentrate, sand and gravel, feldspar, lead, silver, gem stones, copper, zinc, gold.
Navajo	2,253,126	3,170,572	Uranium ore, stone, copper, sand and gravel, coal, gem stones, silver, zinc, gold.
Pima	66,089,879	91,324,508	Copper, cement, sand and gravel, gold, zinc, molybdenum, silver, stone, manganese ore and concentrate, lead, clays, gem stones, manganiferous ore and concentrate, perlite.
Pinal	78,450,806	61,236,788	Copper, molybdenum, sand and gravel, gold, manganese ore and concentrate, silver, gypsum, lime, stone, perlite, pyrites, manganiferous ore and concentrate, lead, zinc.
Santa Cruz	1,266,720	1,130,477	Zinc, lead, silver, copper, gold, sand and gravel, gem stones.
Yavapai	16,399,450	21,643,699	Copper, zinc, lead, gold, silver, sand and gravel, lime, stone, cement, molybdenum, uranium ore, gem stones, gypsum, manganese ore and concentrate, clays.
Yuma	1,652,166	1,794,254	Manganese ore and concentrate, sand and gravel, manganiferous ore and concentrate, copper, gem stones, gold, mica (scrap), silver.
Undistributed	288,528	[1] 682,697	
Total [2]	314,520,000	326,888,000	

[1] Includes manganese ore and concentrate and gem stones that cannot be assigned to specific counties.

[2] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

Cochise.—The value of mineral production in the county ($32 million) declined 16 percent ($6.1 million) as a result of a labor strike which idled some of the major copper producers during the latter part of the year. The value of the copper output declined from $33.5 to $28 million. Copper supplied 87 percent of the total value of mineral production, gold 4 percent, and silver 2 percent. Other metals produced were lead, zinc, manganese ore and concentrate, manganiferous ore and concentrate, and uranium, which together accounted for 1 percent of the total value of mineral production in the county.

Most of the copper output came from the Copper Queen and Lavender mines, Copper Queen Branch, Phelps Dodge Corp. The company was the fifth largest copper producer in the State and ranked second in gold and silver output. According to the company's annual report for 1959, 373,395 tons of copper ore was produced from the Copper Queen underground mines and 3.2 million tons from the Lavender open-pit mine at Bisbee. In addition, 3.1 million tons of leach material and 1.7 million tons of waste rock were mined from the Lavender pit. Part of the ore from the Copper Queen mine was shipped to the company smelter at Douglas, and part was treated at the concentrator at Bisbee. All of the ore from the pit went to the concentrator. About 3.3 million tons of ore was treated—99,000 tons from the underground mines and 3.2 million tons from the pit. The concentrate shipped to the smelter totaled 244,324 tons and copper precipitates produced for smelting 6,409 tons. Copper production from the Copper Queen and Lavender mines was reported as 19,556 and 25,551 tons, respectively.

Johnson Camp, the next largest producer of copper, was the principal zinc producer. Strong & Harris, Inc., mined siliceous flux containing silver and copper from the Chicora claim for part of the year, and McFarland & Hullinger mined copper-zinc ore with silver from the Moore shaft during the last few months.

Nonmetals produced in the county were valued at $2.1 million. Sand and gravel quarried by contractors for the Arizona Department of Highways was the principal nonmetal; next in order were crushed limestone, sandstone, and marble. The limestone was used as flux, in concrete, as roadstone, and for lime manufacture. The sandstone was consumed principally as smelter flux, and the marble was used for roofing granules. Limekilns were operated near Paul Spur by Paul Lime Plant. James C. Stewart Co. and Charleston Mines, Inc., produced sericite mica at the Charleston mine near Tombstone.

San Xavier Rock & Sand Co. mined scoria from its pit near the Bernardino rail siding.

Coconino.—The value of nonmetals accounted for 62 percent of the total value of all minerals produced in the county. Contractors for the county and State highway departments supplied virtually all of the sand and gravel output. Crushed and dimension sandstone produced from quarries around Ashfork and Drake accounted for the entire output of stone. The Winona and Flagstaff scoria deposits were operated by the Atchison, Topeka, and Santa Fe Railway Co., Harenberg Block Co., Inc., and Superlite Builders Supply Co.

Coconino County was third in the production of uranium ore. Principal producers were Western Gold & Uranium, Inc., at the Orphan mine, and Rare Metals Corp., at the Huskon and Ramco mines. Western Gold & Uranium, Inc., completed its 1,600-foot vertical shaft on the rim of the Grand Canyon and drove a 900-foot crosscut on the 1,500-foot level to the ore body. Connections with other levels were made, and at yearend virtually all ore was being hoisted through the new shaft. The ore was shipped to mills in Arizona, New Mexico, and Utah. Rare Metals Corp. operated its 300-ton-per-day processing plant at Tuba City throughout the year. Crude ore came from Rare Metals Corp. operations, Western Gold & Uranium, Inc., and numerous independent operators in the Cameron district.

A total of 893 long dry tons of manganese ore and concentrate, averaging 42.4 percent manganese and valued at $85,000, was shipped to the Government from nine mines under the carlot-purchase program administered by GSA.

Coal was produced from the Cow Springs No. 3 mine by Lawrence Isaac Coal Co.

Gila.—The total value of mineral production increased 16 percent (from $43.1 million in 1958 to $50.2 million in 1959), principally as a result of a 22-percent increase ($39.7 to $48.5 million) in the value of copper output. This rise in copper value resulted partly from increased output from three of the county's principal producers—Inspiration, Miami, and Castle Dome—and partly from a higher average price for copper in 1959.

The Inspiration mine, operated by Inspiration Consolidated Copper Co., the fourth largest copper producer in the State, operated throughout 1959 on a 6-day-per-week operating schedule to meet the needs of the metallurgical plants for full-capacity operation. According to the company's 1959 annual report, 5.4 million tons of ore was mined with a copper content of 0.392 percent in the oxide minerals and 0.466 percent in the sulfide minerals. A total of 4 million tons of waste was removed, of which 1.2 million tons was segregated and placed on a dump for leaching to recover the contained copper. The ore, from which the fine material was removed for separate treatment, was leached with dilute sulfuric acid to dissolve the recoverable copper oxide in the ore and approximately 40 percent of the recoverable copper sulfide. The copper solution went to the tankhouse for electrolytic separation and refining of the copper. The tailing from the leaching operation was treated in the company concentrator by flotation to recover the remaining sulfide copper content. The fine fraction of the ore removed before leaching was concentrated and the tailing leached. The copper concentrate was re-treated in the molybdenum recovery plant, and 380,347 pounds of molybdenum contained in molybdenite concentrate was produced during the year. Then the copper concentrate was smelted to recover the copper, which was cast into anodes and refined in the electrolytic plant. In addition, the company leached mined-out areas of the mine and open-pit waste dumps with dilute sulfuric acid to produce a low-cost copper.

Development and construction activities at the Christmas mine by Inspiration Consolidated Copper Co., which were slow in 1958, were accelerated in 1959. Underground development proceeded without interruption during the year. Beginning in July the pilot plant at the mine was operated at a rate of about 100 tons per day, on ore produced from development headings, to determine the metallurgical flowsheet to be used in the new concentrator. Sinking of the McDonald shaft was begun in December, and by yearend the shaft had reached a depth of 77 feet, of which 66 feet had been concreted. Barring unforeseen delays or difficulties, the company officials expect to complete this project and reach the planned capacity of 4,000 tons of ore per day by late 1961.

According to the Miami Copper Co. annual report, copper production from its three divisions, Copper Cities (7th largest copper producer in the State), Miami Copper (13th), and Castle Dome (14th), totaled 31,536 tons, compared with 33,368 tons in 1958. The lower output was due primarily to cessation of underground mining at the Miami mine about midyear and conversion to in-place leaching.

Fifteen other mines produced ore from which gold, silver, copper, or lead was recovered. Chillito and Copper Hill were the largest.

Although clays, gem stones, lime, sand and gravel, and stone were produced in Gila County chrysotile asbestos was the most valuable nonmetal. Owing to the culmination of the Government purchase program for asbestos only four companies were operating. Noteworthy was the completion of the Metate Asbestos Corp. mill 3 miles east of Globe. The plant was expected to produce 30 tons of Grades 3 to 7 finished fiber per week. The prolonged copper strike adversely affected the only lime plant active in Gila County; output fell to 9,200 tons—39 percent below 1958. A decrease in highway construction and maintenance reduced production of sand and gravel. Crushed limestone, used to produce lime and in concrete aggregate and roadstone, accounted for the bulk of the stone.

A total of 1,904 long dry tons of manganese ore and concentrate, having an average manganese content of 43.9 percent and valued at $188,000, was produced from 10 mines and shipped under the Government carlot-purchase program. The Vertical Magnet was the largest producer. In addition, small quantities of manganiferous ore and concentrate were marketed from two mines. Activity and production were reported from three mercury mines: Gold Creek, Mercuria, and Rattlesnake.

Graham.—Nonmetals accounted for 99 percent of the value of all minerals produced. Contractors for the State highway department produced 194,400 tons of paving sand and gravel, and 400 tons of crushed miscellaneous stone was used on the San Carlos Indian Reservation. The Gila Cinder Co. produced 4,190 tons of volcanic cinders (scoria) for use at the Gila Valley Block Co. plant. Metals output (gold, silver, and copper) came from copper and silver ores from the Copper Reef and Princess Pat mines, respectively.

Greenlee.—The Morenci open-pit mine, operated by Phelps Dodge Corp., was again the State's leading copper producer. It also ranked second in molybdenum, fourth in silver, and sixth in gold and supplied most of the value of the county's mineral production. According to the company's annual report, 29.4 million tons of material was mined, of which 10.5 million was ore and 18.9 million was waste and leach material. The concentrator treated 10.5 million tons of ore, and 325,672 tons of concentrate was smelted during the year. As a byproduct of the copper concentrates, 694 tons of molybdenite concentrate was produced. From all sources (milling of ore and leaching of dumps), 74,997 tons of copper was produced, compared with 96,588 tons in 1958. A limekiln also was operated by the company. The principal capital expenditures during the year were for additional mine railroad to the pit and for removal and reerection of mine shop buildings, resulting from enlargement and extension of the mine to include ore indicated by development drilling.

Maricopa.—Nonmetals accounted for 81 percent of the total value of all minerals produced. Maricopa County was again the leading producer of sand and gravel, despite a 7-percent drop in total output. Commercial production consisted of 3.3 million tons or 71 percent of the sand and gravel output; Government-and-contractor output comprised the remainder. Production of miscellaneous clay by Wallapai Brick & Clay Products, Inc., and Western Clay Products Co., Inc., dropped 15 percent below 1958. All of the clay was used in manufacturing building brick and other heavy-clay products. Scrap mica was produced from the Buckeye mines and ground at a mill near Buckeye operated by Buckeye Mica Co. The U.S. Army Corps of Engineers quarried and crushed nearly all of the miscellaneous stone output.

Manganese and manganiferous ore and concentrate production accounted for most of the value of metal output in the county (19 percent of the total value of mineral production). Manganese ore and concentrate was produced and shipped from 12 mines and was shipped under the Government carlot-purchase program; manganiferous ore came from 3 mines and was shipped to Mohave Mining & Milling Co., which prepared and shipped it under contract to Kaiser Steel Corp., Fontana, Calif., for use in making steel. The gold, silver, copper, and lead output came from four active mines in the county; the Orizaba mine was the largest producer.

Mohave.—Three-quarters of the total value of mineral production in the county came from the output of manganese and manganiferous ore and concentrate. Manganese ore and concentrate was produced from 11 mines and shipped under the Government carlot-purchase program. The major producers were the American and Priceless mines. Manganiferous ore was shipped from two mines through Mohave Mining & Milling Co. to Kaiser Steel Corp., Fontana, Calif., for use in making steel.

Other metals produced in the county included gold, silver, copper, lead, and zinc from five mines. All were small producers except the McCracken mine operated by Ari-Vada Development Co.

The entire output of feldspar and crushed stone (quartzite) was from mines leased by International Minerals & Chemical Corp. The crude materials were crushed at the company's Kingman mill.

Navajo.—The county was the leading producer of uranium ore. Major producers were Industrial Uranium Co. at the Moonlight, Big Chief, Sunlight, and Star Light 1 mines; Gibraltar Minerals Co. at the Boot Jack mine; and Inar Norgaard at SM68 Tract 11 and Tract 17 mines.

Six oil wells were completed, but no completions were successful; total drilling was 24,111 feet. Hopi Indian Agency operated the Keams Canyon No. 4 coal mine and consumed the entire output.

Pima.—Copper furnished 83 percent of the value of mineral production. Five mines, New Cornelia (2d largest copper producer in the State), Silver Bell (8th), Esperanza (9th), Pima (10th), and Daisy-Mineral Hill (15th), supplied 99 percent of the county's and 29 percent of the State's output.

In its annual report for 1959, Phelps Dodge Corp. reported that 24.9 million tons of material was moved from the Ajo open-pit mine by the New Cornelia Branch; 9.8 million tons was ore and 15.1 million tons waste. The concentrator treated 9.8 million tons of ore, and the smelter treated 237,981 tons of concentrate. This operation produced 70,949 tons of copper, compared with 54,929 tons in 1958. Two heavy-duty rotary drills and a tractor-mounted travel drill were purchased during the year and added to the equipment in use.

The county's second largest copper producer, the Silver Bell Unit of American Smelting and Refining Co., was not affected by the labor strike and operated throughout the year. Molybdenum was recovered as a byproduct of retreating copper concentrate to recover a molybdenite concentrate.

Duval Sulphur and Potash Co. completed milling facilities in February and began producing copper in March at the Esperanza open-pit mine near Tucson. This development cost $20 million. Removal of waste rock overlying the deposit was started in November 1957 and continued into 1959. The copper concentrate was re-treated to produce a byproduct molybdenite concentrate. The resulting copper concentrate, containing 25 to 30 percent copper, was sold to custom smelters, and the molybdenite concentrate was further treated to produce molybdic trioxide which was sold principally to steel mills for use as an alloying agent. The mine and mill were operated continuously, but concentrate was stockpiled at the mill during the labor strike which affected the custom smelter. The milling rate increased from 8,950 tons per day in March to 11,515 tons in December.

Cyprus Mines Corp., which owned one-half interest in the Pima Mining Co., stated in its annual report that 1.2 million tons of ore was mined and milled from the Pima mine in 1959. Although mill recovery and concentrate grade improved, the grade of ore declined from 1.8 to 1.4 percent copper. Output of copper concentrate was 56,590 tons, or 15 percent less than the output of 67,591 tons in 1958. Operations continued without interruption throughout the year. Copper concentrate was stockpiled during the last 4 months of the year because of the labor strike. At yearend, mill revisions were being made to increase the rated daily capacity from 3,000 to 3,600 tons. Development and exploration were continued, and at the close of the year the proved reserve was 5.9 million tons of 1.8-percent copper ore according to Cyprus Mines Corp. officials.

The 1959 annual report of Banner Mining Co. stated that an agreement was concluded with Pima Mining Co. in November whereby Pima would extend its open pit and mine and mill ore from the Daisy mine from 1962 to 1968 at an average rate of 256,000 tons per year. Production in 1959 from the Daisy mine by Banner was 72,432 tons compared with 101,033 tons in 1958. Core drilling on lands leased from the State 1 mile northeast of the Daisy mine was continued by the company during the first 8 months of 1959. This drilling outlined lower grade ore 700 feet below the surface, which might be mined by open-pit methods, and higher grade ore at depths ranging from 650 to 1,100 feet, which could be mined by underground methods. The five-compartment Palo Verde shaft which is to be sunk to a depth of 1,000 feet to mine the higher grade ore was started, and the installation of the surface plant and purchase of the necessary mining equipment was authorized by the company board of directors. A small quantity of ore was mined and milled from Mineral Hill mine near the mill. A lease and option agreement was concluded by Banner with McFarland & Hullinger for acquisition of the San Xavier mine and surface plant.

Most of the gold and silver was produced as a byproduct of copper mining. Lead came mainly from the San Xavier mine operated by

McFarland & Hullinger, and from the Daisy-Mineral Hill and Sunshine group of mines. The Atlas, operated by B.S. & K. Mining Co., and San Xavier mines were the major zinc producers. Twenty lode mines that produced gold, silver, copper, lead, or zinc were active in the county, and a placer mine sold small quantities of gold and silver.

Cement produced at the Rillito plant of Arizona Portland Cement Co. was the principal nonmetal product. Virtually the entire output of limestone was used in making cement. Pima County was the second largest producer of sand and gravel, and commercial operations supplied 62 percent of the 1.8 million tons quarried. Tucson Perlite Co. operated its perlite mine and Tucson expanding plant. Miscellaneous clay for use at local brick plants accounted for all of the clay output.

Manganese ore and concentrate were shipped from the Black Jack and Stella Maris No. 1 mines under the Government carlot-purchase program that terminated in August. In addition, a substantial quantity of manganiferous ore and concentrate was shipped from one mine through Mohave Mining and Milling Co. to Kaiser Steel Corp., Fontana, Calif., plant for use in making steel.

Pinal.—Copper supplied $56.1 million (92 percent) of the $61.2 million value of mineral production. Gold and silver, mostly of which was recovered from copper ore, and molybdenum, all from copper ore, furnished 4 percent of the total value; the remaining 4 percent was primarily from sand and gravel, gypsum, manganese and manganiferous ore and concentrate, and lime.

The major copper-producing mines, in order of output, were San Manuel (3d in the State), Ray (6th), and Magma (11th). All produced large quantities of gold and silver. San Manuel was one of the principal producers of molybdenum as a byproduct of copper.

Magma Copper Co., sole owner of the San Manuel Copper Corp. and operator of the San Manuel mine, stated in its 1959 annual report that 7.6 million tons of ore assaying 0.719 percent copper was produced from the sulfide minerals from this mine, compared with 11.5 million tons assaying 0.716 percent copper in 1958. The copper contained in the oxide minerals in the ore was not recovered. An average of 13.05 pounds of copper was recovered per ton of ore treated, compared with 13.01 pounds in 1958. The 34-percent decline in tons of ore produced resulted from a strike called at San Manuel by the International Union of Mine, Mill and Smelter Workers, Inc., on August 11, which stopped all production from that date until December 15. San Manuel quarried 39,928 tons of limestone and 9,312 tons of quartzite for metallurgical use during the year.

Kennecott Copper Corp. stated in its annual report for 1959 that 3 million tons of ore was mined from the Ray mines by the Ray Mines Division, compared with 4.3 million tons in 1958. Copper production from all Ray operations was 29,084 tons of copper, compared with 42,932 tons in 1958. The decline resulted from the labor strike and inactivity at the Ray mines from early August throughout the rest of the year. Expansion of productive capacity, announced in 1958, neared completion at yearend. Expansion involved relocating surface facilities, enlarging the pit to permit mining more ore, and increasing the capacity of the mill and was to cost over $35 million.

Productive capacity was to be increased by 20,000 tons of copper annually, or nearly 40 percent.

According to the Magma Copper Co. annual report for 1959, 276,387 tons of ore assaying 5.23 percent copper, 0.04 ounce per ton of gold, and 1.50 ounces per ton of silver was mined from the Magma mine at Superior. All production was stopped because of the labor strike from August 11 throughout the rest of the year. Metal production at Magma was 13,009 tons of copper, 9,298 ounces of gold, and 367,955 ounces of silver, a substantial decline from the 1958 output of 20,651 tons of copper, 12,581 ounces of gold, and 550,327 ounces of silver. Development work at the Magma mine during the year comprised 8,033 feet of drifts and crosscuts, 5,877 feet of raises, 106 feet of shaft sinking on the No. 5 shaft, and 3,092 feet of diamond drilling.

Crude material from mines and quarries producing gypsum (Arizona Gypsum Corp. and Union Gypsum Co.), perlite (Perlite Industries of Arizona, Inc., and Harborlite Corp.), pyrite (Kennecott Copper Corp. and Magma Copper Corp.), lime (San Manuel Copper Corp.), and sand and gravel—used principally in highway construction and maintenance—was responsible for the value of nonmetals produced.

Santa Cruz.—Production of gold, silver, copper, lead, and zinc came from 10 mines, of which the Flux, Glove, Illinois and Venados, and Kansas were the major producers. The Flux (operated by Nash & McFarland) and Glove (operated by Sunrise Mining Co.) mines were the State's second and third largest lead producers, respectively; the Flux mine ranked fourth in zinc output.

Yavapai.—The Iron King mine, operated by the Iron King Branch of Shattuck Denn Mining Corp., was the State's leading silver, lead, and zinc producer and third largest gold producer. This mine again was one of the major contributors to the value of mineral production. Approximately 1,000 tons a day of ore was mined and milled at Iron King. Lead and zinc concentrates (containing significant quantities of gold, silver, and copper) produced by flotation were shipped to American Smelting & Refining Co. smelters at El Paso, Amarillo, and Corpus Christi, Tex. Gold bullion was produced by cyanidation of the flotation tailing.

Bagdad Copper Corp. mine at Bagdad continued to be the principal producer of copper in the county and was the 12th largest producer in the State. Byproduct gold, silver, and molybdenum also were recovered from copper mining and milling. The strike during the last 4 months of the year did not affect operations at Bagdad except to close the smelter to which they shipped concentrate, necessitating stockpiling of concentrate at the mill. Plans were announced for installing a plant to produce sulfuric acid by burning sulfur. The acid would be used for leaching oxide copper from stockpiled material removed from the sulfide copper ore being used for millfeed. This procedure was expected to add 20 tons per day to the copper output of the operation.

Cyprus Mines Corp. reopened the Old Dick mine near Bagdad in January after a year of inactivity. It was the State's second largest zinc producer and ranked 16th in copper output. Gold, silver, and lead also were recovered from the copper-zinc ore. According to the corporation's annual report for 1959, 76,111 tons of ore was mined and milled to produce 8,078 tons of copper concentrate and 19,350 tons of zinc concentrate. Exploration and development at the Old Dick and the nearby Copper Queen mines resulted in additions to the ore reserve approximately equal to production. The reserve was estimated by company officials at 305,000 tons, averaging 4 percent copper and 15 percent zinc.

Other important metal producers in the county included Big Hole Mining Co., which produced copper ore from the United Verde open-pit mine (formerly operated by Phelps Dodge Corp.), and Fred D. Schemmer, who operated the Commercial mine under lease from Phelps Dodge Corp. and produced fluxing copper ore for the corporation smelter at Douglas.

American Cement Corp. began initial operations at its new Clarkdale cement plant. Because of a constructions workers' strike at the Glen Canyon Dam project, only a limited quantity of cement was produced and shipped. Verde Gypsum Co. quarried a little gypsum for use as a retarder in cement. The Flintkote Co. operated its Nelson lime plant at an accelerated rate in 1959 (output was 37 percent greater than 1958). A small quantity of bentonite was produced by Silicates Corp.

The Interstate Oil & Development Co. produced uranium ore at the Anderson No. 2 mine and shipped it to the Tuba City mill for processing.

Yuma.—Output of manganese and manganiferous ore and concentrate furnished $1.5 million of the $1.8 million value of mineral production. Manganese ore and concentrate was shipped from 17 mines under the Government carlot-purchase program. The major producers were the Blackbird, Power No. 1, and Metate No. 3. Manganiferous ore and concentrate was shipped from four mines through Mohave Mining & Milling Co., to Kaiser Steel Corp., Fontana, Calif., for use in making steel; Metate No. 3 was the principal producer.

Gold and silver were recovered from two placer mines and gold, silver, and copper from four lode mines.

The Mineral Industry of Arkansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the Arkansas Geological and Conservation Commission, Norman F. Williams, Director and State Geologist, Little Rock, Ark.

By Harry F. Robertson [1]

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MINERAL production in Arkansas increased nearly 7 percent over that in 1958, resuming the upward trend started in 1952. Spectacular gains in the production of sand and gravel, barite, and bauxite were sufficient to offset a major decrease in crude petroleum production. Steps were taken to promote further industrial development in the State.

To aid nonprofit industrial development groups in Arkansas desiring to build commercial sites, an Arkansas cement company offered free cement. Grants totaling almost 18,000 barrels of cement were made to communities. In a related move, a concrete company agreed to sell structural members to civic agencies at a discount.

The Binswanger Glass Co. opened a new plant in Little Rock. It included space for making double-pane insulating windows, electro-copper-plating galvanic processing equipment to manufacture mirrors, selling and erecting glass-curtain walls, and manufacturing and restoring stained-glass windows.

Work continued on the first phase of the Dardanelle Dam project on the Arkansas River. In 1959 construction was confined to building the upstream portion of the lock. When the dam is completed and the Arkansas River opened to navigation, this lock will be the means of lifting or lowering river craft 52 feet between the upstream and downstream levels. Plans include construction of the remainder of the dam extending from the lock to a powerplant on the Yell County side of the river.

Highway construction completed and contracted reached a new record in 1959. According to the Arkansas Highway Commission, the total expenditure during the year was approximately $50 million as compared with $38 million in 1958.

Employment and Injuries.—Average annual employment trend in the mining industries continued downward and was 2 percent less than the average in 1958. Increased employment in coal mining and nonmetallic mining and quarrying failed to compensate for the decreased average employment in the metal mining and oil industries. Although fewer workers were employed in 1959, the mining industry annual payroll gained 1 percent.

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[1] Commodity-industry analyst, Division of Mineral Resources, Region IV, Bartlesville, Okla.

TABLE 1.—Mineral production in Arkansas[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	182,779	$1,668	338,539	$3,097
Bauxite long tons, dried equivalent	1,257,916	11,394	1,631,643	17,048
Clays thousand short tons	578	1,578	782	2,406
Coal do	364	2,744	441	3,482
Gem stones	(2)	23	(2)	18
Iron ore (usable) thousand long tons, gross weight	(3)	(3)		
Lead (recoverable content of ores, etc)			38	9
Manganese ore (35 percent or more Mn) gross weight	22,221	1,737	17,742	1,398
Natural gas million cubic feet	32,890	2,664	[4]42,500	[4]3,500
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons	37,197	2,574	40,730	2,523
LP-gases do	53,518	2,743	55,731	3,048
Petroleum (crude) thousand 42-gallon barrels	28,700	80,934	[4]26,329	[4]72,931
Sand and gravel thousand short tons	8,644	7,039	11,696	11,857
Stone do	8,461	10,178	8,824	10,424
Zinc (recoverable content of ores, etc)			49	11
Value of items that cannot be disclosed: Abrasive stones, bromine, cement, gypsum, iron ore (1958), lime, soapstone and value indicated by footnote 3		7,241		10,042
Total Arkansas [5]		131,603		140,555

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Weight not recorded.

[3] Figure withheld to avoid disclosing individual company confidential data.

[4] Preliminary figure.

[5] Value adjusted to eliminate duplicating value of clays and stone.

TABLE 2.—Average annual employment of mining industries[1]

Industry	1955	1956	1957	1958		1959	
	Employment	Employment	Employment	Employing units	Employment	Employing units	Employment
Metal mining	910	868	962	43	797	39	701
Bituminous-coal mining	536	561	602	29	367	25	394
Crude petroleum and natural gas	2,909	3,061	3,230	368	3,498	372	3,349
Nonmetallic mining and quarrying	2,089	2,159	2,128	104	1,542	108	1,632
Total	6,444	6,649	6,922	544	6,204	544	6,076

[1] Arkansas Department of Labor, Employment Security Division, Little Rock, Ark.

No fatal accidents occurred in coal mines during the year. One fatality was reported by the sand and gravel industry. Five permanent partial injuries were reported—one in zinc smelting, three in sand and gravel mining, and one in stone quarrying. Injury data on the petroleum industry were not available.

The average weekly wage in the metal mining industry was $107.15, a gain of 12 percent over that of 1958; in the coal industry, $90.77, a gain of 9 percent; in the crude petroleum and natural gas industry, $91.79, a gain of 3 percent; and in the nonmetallic mining and quarrying industries, $77.65, a gain of 1 percent.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Twenty bituminous-coal mines were operated in Arkansas—four less than in 1958. However, total coal production for the year increased 21 percent in quantity and 27 percent in value, mainly because of increased production from the Sebastian County underground mines of the Peerless Coal Co. and Quality Excelsior Coal Co. Production from the eight open-pit mines in Arkansas remained almost the same as in 1958.

TABLE 3.—Coal production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	880	$6, 828	1957	508	$3, 976
1955	578	4, 319	1958	364	2, 744
1956	590	4, 601	1959	441	3, 482

A trend toward mechanized mining in the State's underground mines was indicated by the major increase in coal production from mines using cutting machines. A boring-type continuous-mining machine was used at mine No. 2 of the Quality Excelsior Coal Co. in Sebastian County. At the eight strip mines, 5.5 million cubic yards of overburden was excavated and 258,369 tons of coal loaded—a stripping ratio of 21 cubic yards of overburden to 1 ton of coal mined.

Oil and Gas Exploration and Development.—Drilling activity in 104 fields in 27 counties resulted in completion of 422 oil wells, 57 gas wells, and 280 dry holes. Decrease in total number of wells drilled was attributed to diminished activity in the Stephens and Sandy Bend fields.

The overall results of exploratory and field drilling were good during 1959, inasmuch as 72 percent of the completed wells produced oil or gas. Over the entire State, 28 wells were successfully completed as new sources of supply, establishing 17 new fields (9 oil and 8 gas) and 11 new pools (5 oil and 6 gas). Successful outpost wells established significant lateral extensions in at least seven fields during the year.

The deepest well drilled in 1959 was well 2 of the Cheyenne Oil Co. Miles Taylor unit in Columbia County, but it was abandoned as a Smackover lime failure at a total depth of 11,000 feet. The record producing depth, about 9,420 feet, was established in 1959 in the newly discovered Field Bayou oilfield in Lafayette County.

In north Arkansas, dry natural gas was produced from relatively shallow sands of Pennsylvanian, Mississippian, and Devonian ages. Drilling activity in this part of the State resulted in completion of 28 exploratory wells and 37 field wells. The wildcat wells were instrumental in discovery of eight new fields and five new gas sources. Development drilling of 37 wells adjacent to known fields resulted in 32 producing gas wells and 5 dry holes.

TABLE 4.—Oil and gas well drilling and total crew weeks spent in geophysical prospecting in 1959, by counties

County	Drilling[1]						Grand total	Crew weeks[2]
	Proved field wells			Exploratory wells				Reflection seismograph
	Oil	Gas	Dry	Oil	Gas	Dry		
Arkansas								21
Ashley						4	4	
Bradley						2	2	3
Calhoun	10		6	2		5	23	9
Chicot						1	1	4
Clark						1	1	
Cleburne		1			1		2	
Columbia	24		8			10	42	53
Conway			3			2	5	
Crawford		3				1	4	
Dallas								1
Drew						4	4	
Franklin		15			2		17	
Hempstead						2	2	7
Howard						1	1	
Johnson		5					5	
Lafayette	49	4	31	1		30	115	40
Little River						2	2	
Logan		2			1	2	5	
Miller	40	4	14	2		14	74	13
Nevada	17		11			4	32	22
Ouachita	67	1	10			10	88	27
Pope		3	2		2	2	9	
Saline						1	1	
Sebastian		4	3				7	
Union	206	4	52	4		40	306	30
Washington		2	1		1		4	
Yell		1			1	1	3	
Total:								
1959	413	49	141	9	8	139	759	230
1958	480	51	206	21	17	144	919	199

[1] State of Arkansas Oil and Gas Commission, Engineer's Report of Oil and Gas Reservoirs, 1959.
[2] National Oil Scouts and Landmen's Associations, Oil- and Gas-Field Development in the United States: Vol. 30, 1959.

In south Arkansas, oil and gas production came from Cretaceous and Jurassic formations. Exploratory and development drilling, conducted in 15 counties and 85 fields, totaled 706 wells completed. Of the 706 wells completed, 139 were wildcat and resulted in discovery of 9 new oilfields and 6 new pools (5 oil and 1 gas). Development drilling resulted in significant extensions to the Sandy Bend, Smackover, Champagnolle Landing, and Stamps fields. Of the 166 fields found by the end of 1959, 142 remained active in production of oil, condensate, or gas. Almost all the fields in southern Arkansas produced from multiple sources.

Primary-pressure maintenance and secondary-recovery programs were active in several south Arkansas fields during 1959. Pool unitization followed by water or gas injection successfully prolonged the productive life of fields in Columbia, Lafayette, Miller, Ouachita, and Union Counties. It was estimated that 110 million barrels of oil would be recovered as a direct result of the programs.

Pipeline Construction.—Arkansas–Louisiana Gas Co. completed construction of a 100-mile, 16-inch natural-gas pipeline in west Arkansas. The pipeline extended from the Aetna gasfield in Franklin County to the Arkansas–Louisiana Gas Co. system near Jones Mill.

Natural Gas.—Natural gas production continued an upward trend for the third consecutive year, increasing 29 percent over production in 1958. The north Arkansas gasfields for the first time accounted for more than half of the total gas produced in the State. Gas output in south Arkansas declined, principally because of the lack of new gas discoveries over the past several years. Fifteen counties reported natural gas production. In order of production value, the leaders were Franklin, Columbia, Lafayette, Pope, and Sebastian.

Natural-Gas Liquids.—Although wet-gas production declined in south Arkansas, more natural-gas liquids were recovered by the State's five natural gasoline plants and two cycling plants because of increased plant capacity and the processing of more imported gas.

Arkansas-Louisiana Chemical Corp. completed a $3 million expansion program at its Hamilton Products extraction plant near Magnolia. Capacity of the plant was increased to 400 million cubic feet daily, recovering ethane, propane, butane, isopentane, and natural gasoline at more than double the former volume of liquids.

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas[1]

	Proved reserves, Dec. 31, 1958	Changes in proved reserves, due to extensions and new discoveries in 1959	Proved reserves, Dec. 31, 1959 (production was deducted)	Change from 1958, percent
Crude oil.................thousand barrels..	317, 865	19, 868	312, 911	−2
Natural-gas liquids[2]..................do....	34, 150	450	32, 017	−6
Natural gas..............million cubic feet..	1, 388, 337	99, 615	1, 422, 817	+2

[1] American Gas Association, and American Petroleum Institute, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vol. 13, Dec. 31, 1959, pp. 9, 10, 19.

[2] Includes condensate, natural gasoline, and LP-gases.

TABLE 6.—Gross withdrawals and disposition of natural gas, in million cubic feet

Year	Gross withdrawals[1]			Disposition			
	From gas wells	From oil wells	Total	Marketed production[2]		Repressuring	Vented and wasted[3]
				Million cubic feet	Value (thousands)		
1950–54 (average)............	37, 964	27, 082	65, 046	42, 002	$1, 849	19, 279	3, 765
1955..........................	19, 000	36, 000	55, 000	32, 123	1, 799	16, 649	6, 228
1956..........................	16, 000	37, 000	53, 000	30, 162	1, 810	16, 269	6, 569
1957..........................	18, 000	36, 000	54, 000	31, 327	2, 256	16, 045	6, 628
1958[4].......................	23, 000	45, 000	68, 000	32, 890	2, 664	28, 180	6, 930
1959[5].......................	----------	----------	----------	42, 500	3, 500	----------	----------

[1] Marketed production plus quantities used in repressuring, vented, and wasted.

[2] Comprises gas sold or consumed by producers, including losses in transmission, quantities added to storage, and increases in gas in pipelines.

[3] Includes direct waste on producing properties and residue blown to air.

[4] Revised figures.

[5] Preliminary figure.

TABLE 7.—Natural-gas liquids produced

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	57, 557	$4, 022	48, 518	$1, 993	106, 075	$6, 015
1955	47, 483	3, 239	57, 088	2, 169	104, 571	5, 408
1956	41, 529	2, 541	56, 146	2, 293	97, 675	4, 834
1957	39, 869	2, 313	54, 034	2, 097	93, 903	4, 410
1958 [1]	37, 197	2, 574	53, 518	2, 743	90, 715	5, 317
1959	40, 730	2, 523	55, 731	3, 048	96, 461	5, 571

[1] Revised figure.

TABLE 8.—Production of crude petroleum in Arkansas, by fields

(Thousand barrels and thousand dollars)

Field	1955	1956	1957	1958		1959 [1]	
	Quantity	Quantity	Quantity	Quantity	Value	Quantity	Value
Atlanta	483	438	399	228	$643	148	$409
Bradley West	--------	499	--------	--------	--------	--------	--------
Buckner	478	444	415	363	1, 024	332	920
Dorcheat-Macedonia	617	632	721	303	854	314	870
El Dorado	857	923	990	826	2, 329	646	1, 789
Fouke	1, 241	1, 431	1, 468	1, 279	3, 607	855	2, 369
Horsehead	816	403	188	--------	--------	--------	--------
Magnolia	2, 890	3, 609	4, 521	4, 058	11, 444	4, 439	12, 296
McKamie	1, 331	1, 349	1, 337	976	2, 752	755	2, 091
Midway	2, 048	2, 238	2, 299	2, 046	5, 770	2, 196	6, 083
Shuler	2, 593	2, 353	2, 119	1, 791	5, 051	1, 849	5, 122
Smackover	4, 678	4, 466	4, 206	4, 114	11, 601	4, 363	12, 085
Stephens	1, 014	1, 157	1, 745	1, 681	4, 740	1, 472	4, 077
Village	846	811	776	721	2, 033	398	1, 103
Wesson	1, 840	1, 591	2, 491	2, 239	6, 314	1, 525	4, 224
Other fields [2]	6, 637	7, 011	7, 372	8, 075	22, 772	7, 037	19, 493
Total	28, 369	29, 355	31, 047	28, 700	80, 934	26, 329	72, 931

[1] Preliminary figures.
[2] Bureau of Mines figures.

TABLE 9.—Production, indicated demand, and stocks of crude petroleum, by months, 1959, in thousand barrels

Month	Production	Indicated demand	Stocks [1]	Month	Production	Indicated demand	Stocks [1]
January	2, 510	2, 489	2, 092	August	1, 950	1, 876	2, 220
February	2, 116	2, 322	1, 886	September	2, 005	1, 971	2, 254
March	2, 276	2, 299	1, 863	October	1, 940	1, 990	2, 204
April	2, 433	2, 617	1, 679	November	1, 883	1, 943	2, 144
May	2, 490	2, 527	1, 642	December	2, 075	2, 184	2, 035
June	2, 439	2, 069	2, 012				
July	2, 212	2, 078	2, 146	Total	26, 329	26, 365	--------

[1] End-of-month stocks originating in Arkansas.

Petroleum.—Crude petroleum was the State's most important mineral commodity in 1959 with an estimated 26.3 million barrels valued at $72.9 million. Crude oil production decreased 9 percent in quantity and 10 percent in value below production in 1958. A strike at the American Oil Co. refinery at El Dorado from July 1 to November 12 substantially reduced the total output of oil for the year. As a direct result of decreased production, the Arkansas Oil & Gas Commission raised its assessment on oil production from 2.5 to 4.0 mills per barrel, effective December 1, 1959.

The Arkansas Water Pollution Commission ordered oil producers in south Arkansas to stop pumping salt water into the Ouachita River and its tributaries. Oil-well owners will be given credit for severance tax up to the entire cost of installing underground salt-water-disposal systems. The producers must reduce pollution 20 percent each year for the next 5 years.

Lion Oil Co., a division of Monsanto Chemical Co., expanded and modernized its refinery at El Dorado. Crude oil capacity of the plant was increased from 29,000 to 33,000 barrels daily. New facilities included a solvent-asphalt extraction unit, which boosted yields of paving-grade asphalt, and a desulfurization unit to improve the quality of diesel fuels and heating oils. A propylene tetramer unit was put into use in October. First shipments of the product, used in detergent manufacture, were made in November to the Inorganic Chemicals Division of Monsanto Chemical Co.

NONMETALS

Abrasive Stone.—Production of novaculite in Hot Spring County increased moderately. The material was processed into grinding pebbles and oil stones.

Barite.—The State's barite industry recovered from the slump in 1958 as shown by the 85-percent gain in production and 86-percent gain in the value of production reported in 1959.

United States Glass & Chemical Corp. began constructing a $500,000 barite and gravel plant at Dierks in southwest Arkansas. Initial capacity was to be about 35,000 tons of barite and 250,000 tons of gravel yearly. The company had about 4,600 acres of land under lease in Howard and Sevier Counties. Unlike the Magnet Cove (Hot Spring County) barite deposits, in which ores containing 55 percent barite are covered by many feet of overburden, the Dierks ore is in surface deposits and contain 10 to 15 percent barite. The ore was to be mined by open-pit methods, in which no blasting will be required, then processed into high-quality finished products including chemical-grade barite.

TABLE 10.—Primary barite sold or used by producers

Year	Short tons	Value (thousands)
1950–54 (average)	386,032	$3,650
1955	462,986	3,755
1956	486,254	4,256
1957	477,327	$4,537
1958	182,779	1,668
1959	338,539	3,097

Bromine.—Michigan Chemical Corp. recovered bromine from oil-well brines at its El Dorado plant. End product of the plant was ethylene dibromide. The company announced plans to double production capacity of the bromine plant before mid-1960. Expansion plans also included doubling the number of special tank cars used to transport bromine.

Cement.—Operation of the Arkansas Cement Corp.'s new plant near Foreman accounted for a significant increase in State output of portland and masonry cements. Total monthly cement shipments to destinations in Arkansas consistently were about 24 percent higher than in 1958. The number of construction contracts in Arkansas was 35 percent higher than the number in 1958.

More efficient facilities for handling cement were installed at the Ideal Cement Co. plant at Okay. Packing and loading facilities were completely modernized, and truck haulage of cement was begun in late 1959.

TABLE 11.—Shipments of all types of finished portland and high-early strength cement to Arkansas from mills

Year	Arkansas (thousand barrels)	Change, percent	
		In Arkansas	In United States
1950–54 (average)	1,974		
1955	2,519	+33	+6
1956	1,843	−27	+6
1957	1,694	−8	−6
1958	2,129	+26	+6
1959	2,624	+23	+9

Chlorine.—Arkansas–Louisiana Chemical Corp. produced liquid chlorine and caustic soda at its Pine Bluff plant. During the latter part of 1959, facilities were installed for manufacturing hydrochloric acid, to be used mainly in acidizing of oil wells.

Clays.—Major uses for clay remained essentially unchanged during the year, but outstanding gains in consumption were noted for both fire clay and miscellaneous clay. Three lightweight-aggregate plants were active during the year, requiring more than twice as much miscellaneous clay used for this purpose in 1958. Comparable increased production of building brick, tile, cement, and refractory materials contributed to the 35-percent gain in quantity and 53-percent gain in value of clay produced.

TABLE 12.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Miscellaneous clays [1]		Fire clay		Total clay	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	202	$269	331	$1,335	533	$1,604
1955	(2)	(2)	(2)	(2)	739	2,376
1956	444	447	275	1,189	719	1,636
1957	226	226	390	1,360	616	1,586
1958	265	264	313	1,313	578	1,577
1959	383	383	399	2,023	782	2,406

[1] Includes clay used for cement.
[2] Included with total clay.

Gem Stones.—Quartz crystals and specimen-grade samples of various minerals contributed to the reported value of Arkansas gem stones. Corbins Mineral Supply accounted for more than half of the value of the 1959 production.

Gypsum.—Production of gypsum, all from Pike County, increased 4 percent over that of 1958. Arkansas Gypsum Co. operated the mine until December, then sold the property to Dulin Bauxite Co.

Lime.—Following the lead of the aluminum industry, the major consumer of Arkansas lime, production of lime increased about 31 percent over that of 1958. Lime also was used for water purification and by the paper, petroleum, sugar-refining, and other industries.

Sand and Gravel.—Production of sand and gravel increased 35 percent over that of 1958, reflecting an increase in construction activity throughout the State. Most of the increase was attributed to the building industry rather than to highway construction.

A plant for producing foundry sand was completed near Guion by the National Silica Products Co. The sand was to be mined, processed locally, and shipped to customers in Shreveport, La.; Tulsa and Oklahoma City, Okla., and Dallas, Tex.

TABLE 13.—Sand and gravel sold or used by producers, by class of operation and uses

(Thousand short tons and thousand dollars)

	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	1,084	$728	1,374	$1,355
Paving	1,294	1,076	1,203	1,121
Gravel:				
Building	1,347	1,401	1,630	1,866
Paving	1,661	1,680	2,105	2,232
Other	623	297	12	17
Undistributed [1]	247	537	649	944
Total sand and gravel	6,256	5,719	6,973	7,535
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving	710	142	2,300	1,862
Building	40	10	----------	----------
Gravel:				
Paving	1,638	1,169	2,423	2,460
Building	----------	----------	----------	----------
Total sand and gravel	2,388	1,321	4,723	4,322
Grand total	8,644	7,040	11,696	11,857

[1] Includes glass, molding, filtering, and other construction, industrial, and ground sands; railroad ballast and miscellaneous gravels; Bureau of Mines not at liberty to publish separately.

Stone.—A record of 8.8 million short tons of stone (including slate) valued at $10.4 million was produced, continuing an upward trend for the eighth consecutive year. Outstanding gains were reported in production of crushed granite, marble, and sandstone, all in the noncommercial category.

Mid-South Limestone By-Products, Inc. was constructing a new plant for producing agricultural limestone at Imboden in northeast Arkansas. Completion was scheduled for mid-1960.

TABLE 14.—Stone sold and used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1955	6,176	$8,026	1958	8,461	$10,178
1956	6,325	8,113	1959	8,824	10,424
1957	7,336	8,871			

Sulfur (Recovered Elemental).—Recovery of byproduct sulfur at gas cycle plants in Columbia and Lafayette Counties declined 20 percent as compared with recovery in 1958. Lion Oil Co. at Magnolia and Olin Mathieson Chemical Corp. at McKamie were the only producers in the State.

METALS

Aluminum.—Production and shipments of primary aluminum reached new records, indicating complete recovery from the 1958 slump. Through research, new uses for aluminum were developed in automobiles, housing, railroad freight cars, bridges, containers, and electrical appliances.

Bauxite.—The output of bauxite in Arkansas was 30 percent higher than production in 1958 and accounted for 96 percent of all U.S. production. Approximately 98 percent of the bauxite was mined in Saline County and 2 percent in Pulaski County.

Reynolds Mining Corp., at open-pit and underground mines in Saline County, was the leading bauxite producer. Production was begun at the company's Wightman mine, deepest underground bauxite mine in the United States. Continuous-mining equipment, similar to that in modern coal operations, was used to mine the ore. Aluminum Company of America ranked second, and Dulin Bauxite Co., with underground and open-pit mines in Saline and Pulaski Counties, ranked third.

Dulin Bauxite Co. sold all its bauxite mines, including the Dixon, 400 BC, Bryant, and McClain, to Reynolds Mining Corp. in February 1959. Production from the mines was stopped in April, and they were put in reserve status.

TABLE 15.—Mine production of bauxite and shipments from mines and processing plants to consumers

(Thousand long tons and thousand dollars)

Year	Mine production			Shipments		
	Crude	Dried bauxite equivalent	Value	As shipped	Dried bauxite equivalent	Value
1950–54 (average)	1,942	1,641	$11,799	1,787	1,609	$13,128
1955	2,050	1,721	14,026	1,939	1,660	14,845
1956	1,966	1,669	14,444	1,817	1,567	14,643
1957	1,625	1,357	12,314	2,004	1,696	16,476
1958	1,516	1,258	11,394	1,586	1,341	13,091
1959	1,940	1,632	17,048	1,827	1,580	17,960

Reynolds Metals Corp. installed equipment at its Hurricane Creek plant to produce over 20 million pounds of hydrated alumina annually. Unique chemical properties of the hydrate and an average particle size of less than 1 micron make it useful in manufacturing ceramic colors, chemicals, and many other products.

Lead and Zinc.—Rush Creek Mining Co. reported shipping a small quantity of lead and zinc concentrates to the smelter. The ore was mined in the old Rush Creek Mining District near Yellville, Marion County.

Manganese.—Arkansas manganese production declined 20 percent, primarily because the Government manganese purchasing program ended August 5, 1959. Ten operators in Independence County shipped 15,165 short tons. Shipments also were reported from Montgomery and Polk Counties. The Federal Bureau of Mines continued to sample, map, and correlate data on manganese and manganiferous limestone deposits in Arkansas.

TABLE 16.—Manganese ores shipped from mines, in short tons

Year	Manganese ore [1]		
	Gross weight	Mn content	Value (thousands)
1950–54 (average)	5,408	2,228	(2)
1955	23,744	11,685	$1,727
1956	29,485	12,525	2,066
1957	23,261	10,000	1,726
1958	22,221	9,440	1,737
1959	17,742	6,714	1,398

[1] Containing 35 percent or more manganese (natural).
[2] Data not available.

In September the Athletic Mining & Smelting Co. reduced slab-zinc output from 60 to 40 percent capacity, and on December 31 closed the smelter completely.

REVIEW BY COUNTIES

Ashley.—Sand and gravel for construction and paving was produced by St. Francis Material Co. and S. C. Chadwick.

Benton.—White River Sand & Gravel Co. produced construction and paving sand and gravel. Paul Davis furnished pit-run gravel for fill. Benton County Highway Department used a substantial quantity of unprocessed stream gravel for roadwork. Independent Gravel Co. quarried and crushed limestone for soil conditioning.

Boone.—McClinton, Inc., quarried and crushed limestone for concrete aggregate and soil conditioner.

Calhoun.—Sand and gravel for construction, paving, and fill was the most important mineral produced in the county. Contributing to total production were St. Francis Material Co., Twin City Gravel Co., Pine Bluff Sand & Gravel Co., Ouachita Aggregate Co., and W. W. Grant. Exploratory drilling resulted in discovery of two new oilfields, Mud Lake and Cross Country Slough. At yearend 7 of

TABLE 17.—Value of mineral production in Arkansas, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Ashley	(2)	(2)	Sand and gravel.
Baxter	$1,350	(2)	Do.
Benton	69,271	(2)	Sand and gravel, stone.
Boone	------------	(2)	Stone.
Bradley	6,007	$37,499	Petroleum, sand and gravel.
Calhoun	531,182	639,632	Sand and gravel, petroleum.
Carroll	74,852	(2)	Sand and gravel.
Chicot	4,781	156,128	Do.
Clark	88,876	46,166	Sand and gravel, clays.
Clay	16,566	24,389	Sand and gravel.
Cleburne	------------	50,750	Stone, sand and gravel.
Columbia	26,453,520	26,455,412	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Conway	82,900	57,901	Sand and gravel, natural gas.
Craighead	53,490	115,879	Sand and gravel, clays.
Crawford	376,657	660,525	Sand and gravel, stone, natural gas.
Cross	273,000	241,272	Sand and gravel.
Drew	41,891	23,117	Do.
Faulkner	------------	4,505	Stone.
Franklin	1,305,855	1,941,679	Natural gas, coal, stone.
Fulton	(2)	------------	
Garland	63,476	68,263	Oilstones, sand and gravel, grinding pebbles, gem stones.
Grant	------------	(2)	Clays.
Greene	104,174	128,999	Sand and gravel.
Hempstead	24,360	(2)	Clays.
Hot Spring	2,829,376	4,350,604	Barite, clays, stone, sand and gravel, gem stones.
Howard	(2)	(2)	Cement, stone, sand and gravel, clays.
Independence	2,530,189	2,336,941	Manganese, lime, stone, sand and gravel.
Izard	1,191,477	1,659,100	Stone, sand and gravel.
Jackson	(2)	(2)	Sand and gravel, natural gas.
Jefferson	(2)	(2)	Sand and gravel.
Johnson	1,645,951	1,301,046	Coal, natural gas, clays.
Lafayette	13,271,812	14,145,465	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Lawrence	(2)	(2)	Stone, sand and gravel.
Lincoln	39,550	(2)	Sand and gravel.
Little River	400,430	3,572,385	Cement, sand and gravel, stone, clays.
Logan	400,369	303,925	Stone, coal, natural gas.
Lonoke	(2)	70,083	Clays, stone.
Madison	------------	(2)	Stone.
Marion	12,150	40,560	Stone, zinc, lead, sand, and gravel.
Miller	6,232,027	5,341,146	Petroleum, sand and gravel, natural gas, clays.
Mississippi	60,000	(2)	Sand and gravel.
Montgomery	658,041	671,290	Slate, barite, manganese, gem stones.
Nevada	2,380,760	2,058,895	Petroleum, natural gas, sand and gravel.
Ouachita	17,106,561	13,430,991	Petroleum, sand and gravel, natural gas, clays.
Phillips	65,504	(2)	Sand and gravel.
Pike	180,108	168,741	Gypsum, sand and gravel, gem stones.
Poinsett	83,738	(2)	Sand and gravel.
Polk	218,791	188,655	Manganese, clays, slate.
Pope	787,027	1,337,484	Coal, stone, natural gas, sand and gravel.
Pulaski	7,678,231	8,991,126	Sand and gravel, stone, clays, bauxite.
St. Francis	263,268	(2)	Sand and gravel.
Saline	11,354,884	17,503,092	Bauxite, lime, clays, sand and gravel, talc and soapstone, slate.
Searcy	9,408	------------	
Sebastian	1,028,072	1,783,879	Coal, natural gas, clays.
Sharp	(2)	------------	
Stone	2,500	(2)	Stone.
Union	22,971,993	20,198,567	Petroleum, bromine, natural-gas liquids, natural gas, clays.
Washington	229,147	304,868	Stone, natural gas.
White	(2)	(2)	Stone.
Undistributed	8,399,492	10,144,041	
Total	131,603,000	140,555,000	

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[1] The following counties are not listed because no mineral production was reported: Cleveland, Crittenden, Dallas, Desha, Monroe, Newton, Perry, Prairie, Randolph, Scott, Sevier, Van Buren, Woodruff, and Yell.

[2] Figures withheld to avoid disclosing individual company confidential data; included with "Undistributed."

the 13 development wells in the Mud Lake field were producing oil.

Carroll.—Southeast Construction Co. and Garrett Gravel Co. produced construction and paving sand and gravel.

Chicot.—An outstanding increase in production of sand and gravel for construction and paving added considerably to the economy. Producers were Greenville Gravel Co., Linwood Smith Construction Co., and Townsend Gravel Pit. Exploratory drilling for oil and gas was unsuccessful.

Clark.—Sand and gravel for paving and construction was produced by Arkadelphia Sand & Gravel Co., W. R. Britt, Arlington Waggoner, and R. & P. Barringer. Hope Brick Works mined miscellaneous clay for making heavy clay products. Reynolds Metals Co. aluminum-reduction plant at Arkadelphia contributed to the economy of the county.

Cleburne.—Pit-run gravel and a substantial quantity of crushed sandstone were used for road construction by the U.S. Army Corps of Engineers. Exploratory drilling resulted in discovery of Quitman gasfield and added the county to the State gas producers.

Columbia.—Columbia County output ranked first in value of total production of minerals, crude petroleum, natural-gas liquids, and second in value of production of natural gas. Two natural-gasoline and cycle plants at Magnolia recovered natural-gas liquids (valued at $3.7 million). Both used the adsorption method. Lion Oil Co., a division of Monsanto Chemical Co., recovered sulfur from natural gas, using the "modified Claus" process. Exploratory drilling during the year was unsuccessful. Development drilling in the Stephens oilfield was remarkably successful inasmuch as 22 of the 27 wells produced oil. Columbia County Highway Department crews mined pit-run gravel for paving. Commercial producers of construction, paving, and fill gravel were the Columbia Sand & Gravel Co., Jennie F. Lovell, and Lambert & Barr. Arkansas State Highway Department used part of the gravel produced.

Conway.—Southeast Construction Co. and J. O. Cravens produced construction and paving sand and gravel. Natural gas from Jerusalem and Old Hickory gasfields added to the value of minerals produced in the county.

Craighead.—Sand and gravel for construction and paving gained in importance in 1959. Producers were St. Francis Material Co., Southeast Construction Co., Mississippi Valley Construction Co., Inc., and Cotton Belt Gravel Co. Wheeler Brick Co., Inc., mined red clay for use in making face brick at its plant near Jonesboro.

Crawford.—Arkhola Sand & Gravel Co. continued producing sand and gravel for paving, construction, fill, and other uses. The company also reported production of a considerable quantity of crushed limestone for concrete aggregate and road material. Jim Brewer Services & Supply produced crushed limestone during the year. Development-well drilling added two gas producers to the Kibler-Williams field and one gas well to the Section 10 field.

Cross.—Production of sand and gravel was of major importance to the economy of Cross County. Producers were McGeorge Construction Co., Humphries and Kail, and Cross County Gravel Co.

Drew.—O'Neill Brothers Sand & Gravel Co. and Clyde Rogers produced sand and gravel for paving and fill. Drew County Highway Department mined pit-run gravel for use on county roads.

Franklin.—The county retained first place among natural gas producers in the State for the fifth consecutive year. Two exploratory wells were drilled during the year and added two new gasfields, Peter Pender and Rock Creek, to known gas reserves. Development-well drilling was very successful, especially in the Aetna field, where the State's first quadruple producer was completed. Quality Excelsior Coal Co. operated a strip mine 4 miles northeast of Charleston. Dixie Stone Co. quarried and crushed sandstone for road construction.

Garland.—Norton Pike Co. purchased novaculite, mined near Hot Springs, for shipment to its New Hampshire plant. Oilstones and grinding pebbles were made from novaculite mined by Arkansas Abrasives, Inc., Arkansas Oilstone Co., and Jackson Whetstone Co. Construction sand and gravel was produced by Smith Bros. Construction & Materials Co.

Grant.—Southwest Concrete Material Corp., near Poyen, used clay from a nearby pit as raw material in its lightweight aggregate plant.

Greene.—Arkansas Gravel Co. and B & S Gravel Co. produced construction and paving sand and gravel. Ted Cline furnished bank-run gravel for fill.

Hempstead.—Hope Brick Works mined miscellaneous clay for building brick and other heavy clay products. Exploratory drilling for gas and oil was unsuccessful during the year.

Hot Spring.—Crude barite, the county's most important mineral, was mined and ground by Baroid Division of National Lead Co. and Magnet Cove Barium Corp. Hot Spring County ranked second in production value of clay and crushed sandstone. Acme Brick Co. and Malvern Brick & Tile Co. mined fire clay for refractories and heavy clay products and miscellaneous clay for building brick and tile. Sandstone was crushed and used for making silica refractories by Coogan Gravel Co. and Harbison-Walker Refractories Co. Malvern Gravel Co. produced paving sand and gravel at a stationary plant near Malvern. The Jones Mill aluminum-reduction plant of Reynolds Metals Co. operated throughout the year.

Howard.—Ideal Cement Co. mined chalk, marl, sand, and limestone for cement manufacture. Gravel used for paving and railroad ballast was produced by Nina Dildy.

Independence.—Manganese, valued at $1.2 million, was the most important mineral product of the county. Hydrated lime and quicklime for industrial, chemical, and building uses were produced by Batesville White Lime Co.; the company also quarried and crushed limestone for soil conditioner, metallurgical flux, asphalt filler, mineral food, concrete aggregate, and various other purposes. Batesville Marble Co. was the only producer of dressed monumental marble in the State. Sandstone for rough construction, sawed stone, and dressed stone was produced by Salada Stone Co., Varnell Sandstone Quarry, and Bristow Stone Co. Galloway Sand & Gravel Co. produced building sand and gravel and fill sand.

Izard.—Izard County, for the sixth consecutive year, ranked second in value of stone production and third in value of sand and gravel output. Glass sand and molding sand was mined and processed by Silica Products Co., Inc. Limestone was quarried and crushed by Aluminum Company of America and Arkansas Limestone Co. for metallurgical flux and soil conditioner.

Jackson.—Sand and gravel for structural use, paving, and fill was produced by Allbright Bros. Contractors, Inc., and Mobley Construction Co., Inc.

Jefferson.—Structural and paving sand and gravel were dredged from the Arkansas River by Pine Bluff Sand & Gravel Co.

Johnson.—The county ranked second among coal producers in the State. Both open-pit and underground mines were operated to furnish coal for steel mills and domestic consumption. Atlas Mining Co. was opening an underground mine 10 miles northeast of Ozark. Eureka Brick & Tile Co. mined miscellaneous clay for heavy clay products. Development-well drilling resulted in extensions to the Coal Hill, Knoxville, and Union City gasfields.

Lafayette.—Petroleum and natural-gas industries accounted for most of the mineral economy of Lafayette County. The county led in output of byproduct elemental sulfur and ranked fourth in crude petroleum production, third in natural gas production, and second in natural-gas liquids production. Exploratory and development drilling resulted in discovery of one new oilfield, Field Bayou, new pools in the Lewisville and Stamps fields, oil-extensions in the Lewisville, Spirit Lake, Kress City, and Stamps fields, and gas condensate in McKamie Northeast field.

Sand and gravel for construction and fill was produced by Meriwether Gravel Co., Inc., and Lambert & Barr. Olin Mathieson Chemical Corp. recovered elemental sulfur from natural gas at its McKamie plant.

Lawrence.—Ben M. Hogan & Co. and Verkler Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural use. L. F. Parker produced pit-run gravel for county road construction.

Lincoln.—Sand and gravel for construction, paving, and fill was produced by Glover Bros. Gravel Co. and Andy Ratterree at pits near Star City. Part of the output was used by the Arkansas State Highway Department.

Little River.—The first full year of operation of the Arkansas Cement Corp. plant at Foreman significantly increased the value of mineral production in the county. Portland and masonry cement required substantial quantities of marl and limestone.

Ark-La Limestone Corp. quarried and processed limestone for agricultural use. Braswell Sand & Gravel Co., Inc., produced construction and paving sand and gravel at a stationary plant near Wilton.

Logan.—Sawed building stone and flagging was produced by Schwartz Quarry. Spicer Stone Co., Logan County Building Stone Co., and River Mountain Stone Co. quarried and dressed dimension sandstone.

Four underground bituminous-coal mines utilized cutting machines to produce high-grade coal for shipment to northern markets.

Exploratory drilling during the year resulted in discovery of the Chismville gasfield. Two additional gas wells were completed in the new field by yearend.

Lonoke.—Arkansas Lightweight Aggregate Corp., near England, processed miscellaneous clay to make lightweight aggregate. Arkansas State Highway Department and U.S. Army Corps of Engineers contracted for crushed granite for concrete aggregate and roadstone.

Madison.—Ozark Construction Co. and War Eagle Lime Co., Inc., quarried and crushed limestone for agriculture.

Marion.—Rush Creek Mining Co., near Yellville, reported shipments of lead and zinc concentrates during the year. Arkansas State Highway Department used crushed limestone produced locally for road construction and maintenance.

Miller.—The county ranked second in value of sand and gravel production and fifth in value of clay production. Petroleum and natural gas also were included in mineral resources of the county. Gifford-Hill Co., Inc., produced sand and gravel for construction, paving, railroad ballast, and other uses. W. S. Dickey Clay Manufacturing Co. mined fire clay and miscellaneous clay at pits near Texarkana.

Exploratory drilling resulted in discovery of two new oilfields, Doddridge West and Rodessa West; both fields had an oil-productive outpost well before yearend. Development drilling elsewhere in the county resulted in extensions of the Genoa, Garland City (New), Ft. Lynn, Fouke, Fouke North, and McKinney Bayou fields.

Mississippi.—Elliott Sartain & Co. furnished washed gravel for county road construction and maintenance. U.S. Army Corps of Engineers obtained a substantial quantity of pit-run gravel for backfill in airfield construction at Blytheville.

Montgomery.—Slate was quarried and processed to slate flour and roofing granules by Bird & Son, Inc. Crude barite was shipped from stock by Baroid Division of National Lead Co. Other mineral commodities produced in the county were manganese and gem stones (quartz crystals).

Nevada.—Crude petroleum production was most important to the economy of the county. Small quantities of sand, gravel, and natural gas also were reported. Development drilling indicated substantial additions to oil reserves in the Stephens North, Troy, Willisville Southwest, and Willisville West oilfields.

Ouachita.—Petroleum and sand and gravel supplied most of the value of mineral production in the county. Stephens, Wesson, and Center oilfields continued active production under pool-unitization and water-injection programs. Berry Asphalt Co. operated a petroleum refinery at Stephens.

Construction and paving sand and gravel were produced by Pine Bluff Sand & Gravel Co., Standard Gravel Co., and Graves Bros. Construction Co. Building brick and other heavy clay products were made from miscellaneous clay mined by Hope Brick Works.

Pike.—Gypsum was mined by Arkansas Gypsum Co. for use as a retarder in portland cement. The property was sold December 1, 1959, to Dulin Bauxite Co., who continued operation of the mine and plant. Diamond production at Wilark mine, near Murfreesboro, was reported by A. G. Slocum. A sizable diamond was found by a collector at the "Crater of Diamonds" during the year.

Poinsett.—Crowder Construction Co. and St. Francis Material Co. mined a considerable quantity of sand and gravel for building and paving purposes.

Polk.—Will H. Hargus purchased manganese ore for beneficiating in his mill. W. S. Dickey Clay Manufacturing Co. mined miscellaneous clay for manufacturing heavy clay products.

Pope.—P & M Coal Mining Co. operated a strip mine near Russellville and produced a suitable grade of coal for smelter consumption.

Mid-Continent Stone & Construction Co., a new producer in the county, quarried limestone for riprap in the Arkansas River. U.S. Army Corps of Engineers contracted for sandstone to be used as riprap, concrete aggregate, and roadstone. Sandstone was quarried and dressed to dimension stone and flagging by Texas Ledgestone Co. Sand and gravel was dredged from the White River by Mobley Construction Co.

Exploratory drilling resulted in discovery of the Dover and Ross gasfields.

Pulaski.—The county led in output value of sand and gravel, stone, and kaolinitic clay. Sand and gravel for construction, paving, and fill was produced by Big Rock Stone & Material Co., Jeffrey Stone Co., John D. Ott and Donna Fill Co. Arkansas State Highway Department used a considerable quantity of sand and gravel, mostly pit run, in road construction. Jeffrey Stone Co. quarried and crushed sandstone for riprap, concrete aggregate, and railroad ballast. Producers of crushed limestone for concrete aggregate and roadstone were D. F. Jones Construction Co. and Reynolds & Williams. U.S. Army Corps of Engineers contracted for crushed granite to use as riprap. Big Rock Stone & Material Co. quarried and crushed syenite for use as riprap, concrete aggregate, railroad ballast, and roofing granules. Consolidated Chemical Industries, Division of Stauffer Chemical Co., and A. P. Green Fire Brick Co. processed high-alumina clay from large deposits near Little Rock.

Bauxite was mined or shipped from stock by American Cyanamid Co., Consolidated Chemical Industries, Division of Stauffer Chemical Co., and Dulin Bauxite Co. The two Pulaski County mines of Dulin Bauxite Co. were sold to Reynolds Mining Corp. early in the year. Five companies operated drying, calcining, and activating plants processing bauxite for abrasives, chemicals, and other industrial uses.

St. Francis.—Sand and gravel for construction, paving, and fill were produced by St. Francis Material Co. and J. J. Crisp Gravel Sales.

Saline.—Total value of mineral production in Saline County set a new record in 1959—mostly because of substantial increases in production of bauxite and lime. A. P. Green Fire Brick Co. mined kaolinitic clay for use in refractories. Bauxite, the county's leading commodity, was produced at open-pit and underground mines by Aluminum Company of America, Dulin Bauxite Co., American Cyanamid Co., and Reynolds Mining Corp. Lime, for use in alumina production, was mined by Aluminum Company of America.

Milwhite Co., Inc., quarried and processed soapstone and slate for filler in asphalt, insecticides, roofing, and rubber. Structural and paving sand and gravel were produced by East Arkansas Materials Co., Holland Sand & Gravel Co., and others.

Sebastian.—Coal mining from six underground and two strip mines, was the county's most important mineral industry. Value of coal production in Sebastian County was more than double that in 1958, principally because of increased production by Peerless Coal Co. and Quality Excelsior Coal Co. Miscellaneous clay was mined by Acme Brick Co. and Rescolite Co. for manufacturing heavy clay products and lightweight aggregate, respectively. The county ranked fifth in value of natural gas produced. Development-well drilling resulted in extensions of the Cecil and Massard Prairie gasfields.

Union.—Union County ranked second in total production value of minerals, second in petroleum, and third in natural-gas liquids. Exploratory drilling resulted in discovery of four oilfields—Benjamin Lake, Camp Creek, Hibank Creek, and River's Bend. Development-well drilling was especially successful in extending Champagnolle, Champagnolle Landing, El Dorado East, Lick Creek, Sandy Bend, and Woodley West oilfields and gas-condensate fields. Primary-pressure maintenance and secondary-recovery programs were underway in the Cairo, Catesville, Nick Springs-West, Schuler, Schuler-East, and Urbana fields. Arkansas Oil & Gas Commission estimated that pressure-maintenance operations and unit operation would permit recovery of an additional 37 million barrels of oil from the 6 fields.

The Michigan Chemical Corp. plant near El Dorado recovered a considerable quantity of ethylene dibromide by processing brine from the Smackover lime pool of the Catesville field.

Lion Oil Co., Mobil Oil Co., and J. R. Querles Oil Co. operated cycling and natural-gasoline plants in Union County.

El Dorado Brick Works mined miscellaneous clay for manufacturing building brick.

Washington.—McClinton Bros. and Ozark Construction Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Exploratory drilling resulted in discovery of the county's second gasfield, Brentwood. One producing outpost well was drilled in the new field by the end of 1959.

White.—Acme Materials Co. quarried and crushed sandstone for use as concrete aggregate, roadstone, and riprap.

Yell.—Rush Creek Mining Co. reported production of lead and zinc concentrate in 1959. Exploratory drilling by Shell Oil Co. resulted in discovery of the county's first gasfield, Mt. Nebo. Production was from the Atoka formation.

The Mineral Industry of California

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the California Department of Natural Resources, Division of Mines.

By L. E. Davis [1] and R. Y. Ashizawa [2]

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THE VALUE of California's mineral production in 1959 continued a decline begun in 1958 and dropped below $1.5 billion for the first time since 1955. Mineral fuels, representing 69 percent of the total value, declined to less than $1 billion, the lowest since 1952.

Nonmetallic mineral production continued the steady advance begun several years ago. The value of the 1959 output advanced to 28 percent of the value of all minerals, compared with 24 percent in 1958. Although the major value advances were made by cement, sand

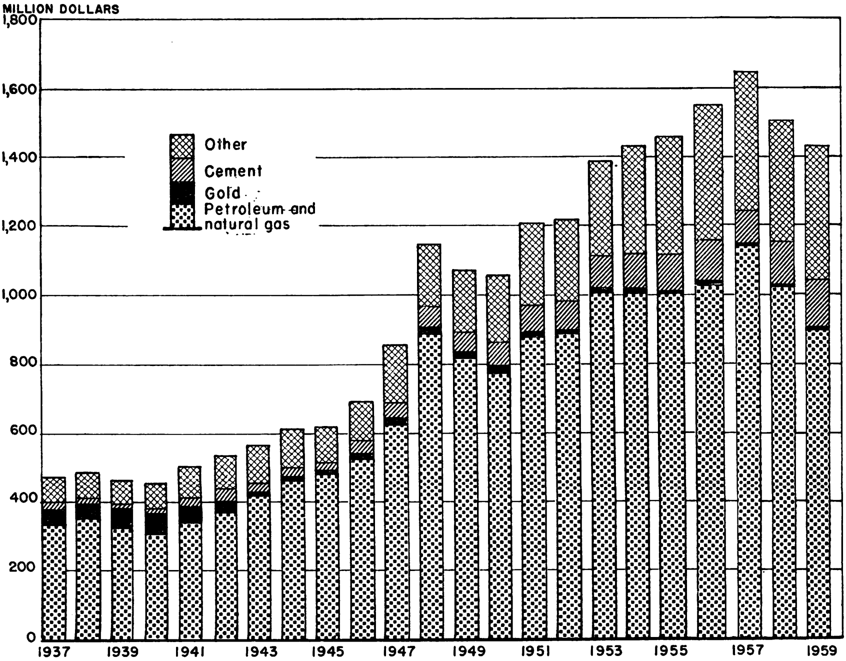

FIGURE 1.—Value of petroleum and natural gas, gold, cement, and total value of mineral production in California, 1937–59.

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and gravel, and boron compounds, 16 additional nonmetallic mineral commodities recorded both production and value increases over the previous year.

The value of metals and metal ores remained at about the same percentage of the State total (less than 3 percent); however, the decline from 1958 was nearly 7 percent. Although major labor strikes during the last half of 1959 undoubtedly had adverse effects on production in the metals group, interest in many of these materials had declined with the ending of each Government purchase program.

TABLE 1.—Mineral production in California [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	24,812	$272	28,143	$326
Boron minerals	528,209	38,310	619,946	46,150
Cement [2] ... 376-pound barrels	39,583,000	124,367	43,635,000	138,506
Chromite ... gross weight	20,588	1,646	(3)	(3)
Clays	2,394,000	5,012	2,726,000	5,646
Copper (recoverable content of ores, etc.)	749	394	663	407
Feldspar ... long tons	71,193	624	76,489	666
Gem stones	(4)	150	(4)	150
Gold (recoverable content of ores, etc.) ... troy ounces	185,385	6,489	146,141	5,115
Gypsum	1,423,000	3,184	1,686,000	3,788
Lead (recoverable content of ores, etc.)	140	33	227	52
Lime	262,000	4,470	358,000	5,817
Magnesium compounds from sea water and bitterns (partly estimated) ... MgO equivalent	74,132	4,854	87,968	6,336
Manganese ore and concentrates (35 percent or more Mn) ... gross weight [5]	17,644	1,516	19,354	1,663
Mercury ... 76-pound flasks	22,365	5,123	17,100	3,890
Natural gas ... million cubic feet	465,582	108,481	[6] 488,664	[6] 114,152
Natural-gas liquids:				
Natural gasoline and cycle products ... thousand gallons	853,045	68,485	834,258	68,023
LP-gases ... do	342,992	18,678	396,331	21,260
Peat	28,617	374	34,604	449
Perlite	14,883	114	(3)	(3)
Petroleum (crude) ... thousand 42-gallon barrels	313,672	909,649	[6] 307,327	[6] 783,684
Pumice	376,789	1,670	574,000	2,162
Salt (common)	1,297,000	(3)	1,388,000	(3)
Sand and gravel	84,137,000	95,340	87,945,000	108,909
Silver (recoverable content of ores, etc.) ... troy ounces	188,000	170	173,000	156
Stone [7]	32,423,000	48,345	32,134,000	49,090
Talc, pyrophyllite and soapstone	[8] 129,638	[8] 1,339	148,266	1,500
Wollastonite	1,652	17	(3)	(3)
Zinc (recoverable content of ores, etc.)	51	10	78	18
Value of items that cannot be disclosed: Asbestos, bromine, calcium chloride, carbon dioxide (1959), masonry cement, coal (lignite), diatomite, fluorspar (1958), iodine, iron ore, lithium minerals, magnesite, scrap mica (1958), molybdenum, platinum-group metals, potassium salts, pyrites, rare-earth metals concentrates, sodium carbonate, sodium sulfate, strontium minerals (1959), sulfur ore, tungsten concentrate, uranium ore, and values indicated by footnote 3	------------	[8] 68,564	------------	73,374
Total California [9]	------------	[8] 1,500,367	------------	1,424,039

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[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes masonry cement.

[3] Figure withheld to avoid disclosing individual company confidential data.

[4] Weight not recorded.

[5] Excludes shipment to Government low-grade depots and custom mills, but quantity and value for this material are as follows: 1958, none; 1959, low-grade manganese ore (129 short tons, $2,876).

[6] Preliminary figure.

[7] Includes slate.

[8] Revised figure.

[9] Total adjusted to eliminate duplicating the value of clays and stone used in making cement and lime.

Employment and Injuries.—Employment statistics collected and compiled by the Federal Bureau of Mines disclosed an overall decline of 4 percent in employment in the mineral industries, not including mineral fuels compared with 1958. This decline was credited almost entirely to metal mining inasmuch as employment in nonmetallic minerals mining and quarrying was lower by less than 1 percent.

Despite an employment drop, injuries rose 5 percent. Fatal injuries were up 25 percent, and nonfatal lost-time injuries rose 4 percent. Fatalities were unchanged in some categories—metal mining (1), sand and gravel operations (4), and basalt quarries (1). Cement plants reported three fatal injuries in 1959, compared with none in 1958. Total injuries per thousand workers rose 8 percent above 1958. This relatively poor injury record was tempered somewhat by the excellent safety record set by the Centerville, Calif., sand and gravel plant of Pacific Cement and Aggregates, Inc. The efforts of the division's 40 employees, who were honored at a testimonial dinner, made possible 10 years of operation without a lost-time accident—since the opening of the plant in 1949. The company also received an award from the National Safety Council.

TABLE 2.—Employment and injuries in the mineral industries[1]

Industry	1958				1959			
	Employees	Injuries			Employees	Injuries		
		Fatal	Nonfatal	Total		Fatal	Nonfatal	Total
Metal mining	2,911	1	134	135	2,300	1	109	110
Nonmetallic mining and quarrying	16,486	7	531	538	16,408	9	585	594
Total	19,397	8	665	673	18,708	10	694	704

[1] Federal Bureau of Mines data, not including the mineral fuels industry.

Consumption, Trade and Markets.—California exceeded all other States in the consumption of most mineral raw materials, and only in those commodities where the State was the only or principal domestic source did production exceed consumption. Therefore, despite this abundance of mineral resources, California was not self-sufficient in mineral requirements.

Probably the best example of this deficiency was mineral fuels. In comparison with the other 49 States, California is second highest in total population, and, although third in production of mineral fuels, the State ranks highest in consumption of liquid petroleum, second in natural gas, and third in total energy consumption. In addition to mineral fuels produced within the State, California consumption in 1959 required nearly 109 million barrels of crude oil and over 738,843 million cubic feet of natural gas (dry) from sources outside the State, including oil imports. California had more motor vehicle registrations and gasoline stations than any other State and was second only to Texas in pipeline mileage. In amount of fuel and vehicle taxes California led the other 49 States; twenty-five percent of its total tax revenue came from this source.

TABLE 3.—Principal custom mills, commercial grinding plants, and primary smelters in 1959

Name	County	Nearest city or town	Minerals processed	Remarks
Industrial Minerals & Chemical Co.	Alameda	Berkeley	Nonmetals	Contract grinding.
Metals Disintegrating Co., Inc.	do	Emeryville	do	Do.
American Smelting & Refining Co.	Contra Costa	Selby	Lead, zinc, silver, gold.	Smelter, refinery, and fuming plant.
Fresno Agricultural Chemical Co.	Fresno	Fresno	Nonmetals	Custom mill.
Huntley Industrial Minerals, Inc.	Inyo	Bishop	do	Do.
Union Carbide Nuclear Co.	do	do	Tungsten ore and concentrates.	1,000 ton-a-day flotation and chemical plant.
Butte Lode Mining Co.	Kern	Randsburg	Gold and silver	Stamp mill, amalgamation and gravity concentrator.
American Minerals Co.	Los Angeles	Los Angeles	Nonmetals	Commercial grinding.
Kennedy Minerals Co.	do	do	do	Do.
Western Talc Co.	do	do	do	Contract grinding.
Industrial Minerals & Chemical Co.	Sacramento	Florin	do	Do.
New Idria Mining & Chemical Co.	San Benito	Idria	Mercury	Custom mill.
Kaiser Steel Corp.	San Bernardino.	Fontana	Iron ore	Blast furnaces, steel plants, and fabricating plants.
Wildberg Bros. Smelting & Refining Co.	San Francisco	San Francisco	Gold, silver, and platinum.	Smelting, refining, and manufacturing.

TABLE 4.—Sand and gravel, crushed stone, and portland cement sold or used in 1959, by method of transportation

Material	Quantity transported, by method (thousand short tons)				
	Railroad	Motortruck	Waterway	Not stated [1]	Total
Sand and gravel (commercial)	3,792	72,030	189		76,011
Crushed stone (commercial)	3,914	22,301	1,742	43	28,000
Portland cement	1,951	6,052	(2)	200	8,203

[1] Includes interplant transfers to batching units, etc.
[2] Included with "Not stated" to avoid disclosing individual company confidential data.

Only a few nonmetallic minerals were produced in sufficient quantity to supply State needs, but the future was brighter for an increase in this commodity group than for either mineral fuels or metals. The value of nonmetallic mineral output had risen every year since World War II. More interest in this group had been displayed in each succeeding year, and exploration and development for these minerals had taken a higher percentage of the "risk" capital invested in mineral mining ventures. Most notable in 1959 was the extensive exploratory work being done at known asbestos prospects. Much of the State's present requirements in nonmetallic mineral raw materials, other than the low-value bulk construction materials, were obtained from nearby States and processed in California plants. Many of these processors also custom milled nonmetallics for consumers who purchased the raw minerals from the producer.

There were few integrated metal industries in California. Except for iron ore and concentrate, lead and lead-zinc ores and concentrates, and precious metals, metal ores and concentrates had to be processed out of State. After successive terminations of Government purchasing programs, few producers of the metals that had been price supported were able to compete on the world market. The end result was a loss of interest in metal mining. Although there was some magnetometer and geophysical exploration for iron ore in Butte County during 1959, exploration and development at metal mines had reached a new low.

Trends and Developments.—The growing population and industrial expansion in California made increasing demands for construction materials, principally in the southern and north-central areas of the State. In the northern part of the State, Calaveras Cement Co., a division of Flintkote Co., announced plans for constructing a $14 million cement plant at Redding. This plant, with an annual capacity of 1.5 million barrels, was scheduled for completion by mid-1961. The company also planned to establish a bulk-cement distribution facility at Springfield, Oreg., which would receive cement by rail from its cement plant at San Andreas, Calif., until its Redding plant was completed. Permanente Cement Co. announced plans for establishing a bulk-cement distribution facility at Eureka, receiving cement by rail from its plant at Permanente, and serving a market from Garberville north into Oregon and eastward to Willow Creek. American Cement Corp. purchased more than 1,500 acres of land in Amador County during 1959. The acquisition consisted of limestone deposits near Volcano and clay deposits and plant sites near Ione. Several southern California concrete-block manufacturers joined forces to establish a plant near Chino in San Bernardino County to thermally expand shale for use as lightweight aggregate.

In Alameda County, a beryllium fabrication plant was under construction for Brush Beryllium Corp. The entire holdings of Empire-Star Mines Co., Ltd., in Nevada County were sold at public auction. Union Carbide Nuclear Co. operated a pilot plant at its Inyo County tungsten refinery, which turned out high-purity ammonium paratungstate. Plans called for expansion of the refinery to incorporate the two new processing steps developed. In Madera County, New Idria Mining and Chemical Co. began reactivation of its Strawberry tungsten mine in anticipation of production in 1960.

Legislation and Government Programs.—In the interest of safety, the city of Torrance, Los Angeles County, enacted legislation during 1959 requiring that sumps be fenced or filled in, leases be cleaned up, and wooden derricks be torn down in most of the Torrance field. Because of these restrictions, a number of operators found it more profitable to abandon marginal wells. This new law, and increasing land value for residential purposes, resulted in 32 wells being abandoned during 1959.

Nine Defense Minerals Exploration Administration (DMEA) contracts under the supervision of the Office of Mineral Exploration (OME) for mineral exploration in California were still in effect at the beginning of 1959. Two contracts for tungsten in Inyo County, one for mercury in Napa County, one for manganese in Riverside County, and one for copper-zinc in Trinity County were terminated before midyear, leaving four in force at yearend—three for mercury and one for copper-zinc. The Government purchase program (carlot) for manganese ended August 5, 1959.

Mining research at California boron mineral mines was accelerated by the Federal Bureau of Mines during the year. Being studied were ground pressures, the effect of humidity on borate ores, and differential movements of open-pit slopes, particularly near faults.

Noteworthy late in 1959 was the signing of an agreement by the Federal Bureau of Mines and the California Department of Natural Resources, Division of Mines, to cooperate in selected mineral studies significant to California. The agreement provided for collaboration by the two agencies in programs of investigation and research. The following studies were to initiate the program: (a) The production of tungsten and molybdenum metal by direct electrolysis of scheelite concentrate; (b) development of useful coproducts from the anorthosite rock of the San Gabriel Mountains; and (c) slope-stability studies in open pits. The work was to be conducted by the Federal Bureau of Mines, using its facilities, equipment, materials, and personnel. The State was to consult and advise the Bureau concerning the work. The State was to contribute $35,000 to the cost of the work to be matched equally with Federal funds.

TABLE 5.—Office of Minerals Exploration contracts active during 1959

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
INYO					
Albert P. Decker	Adamson	Tungsten	Oct. 24, 1957	$32,100	75
Ralph E. Shupe	Round Valley & Tungsten Hill.	do	Sept. 9, 1957	70,680	75
NAPA					
American Western Metals (Murray A. Schutz).	Harrison	Mercury	May 2, 1956	28,540	75
H. L. M. Mining Co	Aetna Springs	do	Feb. 17, 1958	16,520	75
RIVERSIDE					
California Limestone Products	Arlington-Black Jack.	Manganese	Dec. 12, 1957	48,020	75
SAN BENITO					
New Idria Mining and Chemical. Co.	Sulphur-Springs	Mercury	Nov. 12, 1957	96,980	75
SHASTA					
Shasta Minerals & Chemical Co. (Shasta-Phelps Dodge Joint Venture).	Balaklala	Copper-zinc	Aug. 3, 1956	109,820	50
TRINITY					
Archibald Trucking Co	Grizzly	do	Apr. 28, 1958	9,860	50
YOLO					
Trans-Pacific Metals, Inc	Reed	Mercury	June 16, 1958	[1] 78,770	50

[1] Amended August 1959.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Carbon Dioxide.—In November a natural-gasoline plant at Taft, Kern County, began producing liquid carbon dioxide. The output was sold to aircraft companies for freezing rivets and to carbonated beverage plants.

Coal (Lignite).—The State's only active commercial coal-mining operation was a lignite strip mine near Ione, Amador County. Increased demand for the contained montan wax and other byproducts resulted in the mining and processing of a substantially greater tonnage of the crude material than in 1958.

Natural Gas.—Marketed production of natural gas rose 5 percent above that of 1958. Of the total output, 30 percent came from dry-gas fields and 70 percent from oil zones. During 1959, 89 new gas wells were completed successfully in dry-gas fields, 34 more than in

TABLE 6.—Natural gas, natural-gas liquids, and petroleum produced in 1959, by counties [1]

County	Natural gas (million cubic feet)	Natural-gas liquids: Natural gasoline and cycle products (thousand gallons)	Natural-gas liquids: LP-gases from plants (thousand gallons)	Petroleum (thousand 42-gallon barrels)
Butte	9,050			
Colusa	5,180			
Contra Costa	1,436			
Fresno	30,368	28,433	27,246	30,112
Glenn	32,468			
Humboldt	998			
Kern	108,329	225,570	133,499	92,692
Kings	10,571	(2)	(2)	1,824
Los Angeles	58,980	255,153	51,989	68,462
Madera	2,589			
Monterey	3,074			10,995
Orange	28,826	91,257	23,517	34,626
Riverside				3
Sacramento	40,065			
San Benito	1,340			871
San Bernardino	94			119
San Joaquin	5,117			
San Luis Obispo	1,238	(2)	(2)	2,285
San Mateo	26			107
Santa Barbara	18,755	31,081	42,239	23,189
Santa Clara				1
Solano	31,868			
Sonoma	60			
Sutter	2,151			
Tehama	1,089			
Tulare	6,339			47
Ventura	91,982	159,488	84,678	43,613
Yolo	1,295			
Undistributed		43,276	33,163	
Total	[3] 488,664	834,258	396,331	[4] 307,327
Total value (thousands)	$114,152	$68,023	$21,260	$783,684

[1] County figures for petroleum and natural gas by courtesy of California Department of Natural Resources, Division of Oil and Gas.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Less natural gas vented and wasted.

[4] Adjusted State total.

1958. The Beehive Bend-Willows area led the State in the number of new wells for the fourth consecutive year, completing 13 wells. There were 6 new dry-gas field discoveries, 8 successful new pool wildcats, 1 deeper pool test, 4 shallower pool tests, and 10 new outposts drilled primarily to find gas. Development wells totaled 60 for the year.

The increase in successful gas-well completions was indicative of the constantly increasing demand for gas and of the comparative economic advantages, during recent years, of drilling for gas as compared with oil exploration in California. Natural-gas reserves were boosted 1 percent. More than half of the increase was due to successful wildcats. Production was 5 percent of the reserves on January 1, resulting in a net loss of 4 percent for the year. Net production of oil-well gas, after deducting injected gas from all California oilfields, was 984 million cubic feet a day as compared with 955 million cubic feet a day in 1958. The average dry-gas production for 1959 was 412 million cubic feet a day, compared with 367 million cubic feet a day in 1958. The Rio Vista, largest gasfield in the State, yielded 160 million cubic feet a day during 1959, 1 million cubic feet a day less than in 1958.

Natural-Gas Liquids.—Although crude-oil production continued to drop for the sixth successive year, the natural-gas-liquids segment of the industry held its own. The volume of wet gases processed in natural-gasoline plants increased slightly, and the yield of total gas liquids gained 3 percent. Average unit value of the liquids was virtually unchanged from 1958. At yearend, 67 natural-gasoline plants were in operation; 1 new one was built at the North Tejon field in Kern County, but 2 others (1 each in Los Angeles and Santa Barbara Counties) were shut down permanently.

Peat.—Peat production rose 21 percent above 1958, approaching the 1957 output. Almost without exception, the material was sold for use as a soil-improvement agent. More than 50 percent of the total output came from the San Joaquin River Delta in Contra Costa County. Lesser tonnages were produced in Jess Valley, Modoc County; near Banning, Riverside County; and in the Huntington Beach area, Orange County. Although most of the peat was consumed in the State, shipments were made to other Western States and Texas.

Petroleum.—California crude-oil output was 2 percent below 1958 despite a drop in shut-in production capacity from 23,000 to 6,000 barrels a day during 1959. This was the sixth successive year that the State's crude yield has declined. The continuing need for imported oil for California refineries was revealed by a 27-percent increase in crude-oil receipts from foreign countries over 1958. Imports totaled 21 percent of the 1959 refinery charge. Average daily receipts via pipeline, from New Mexico and Utah, increased 26 percent compared with 1958.

The mandatory Federal oil-import program, which became effective March 11, 1959, required considerable realinement of crude sources for individual refineries. The new control system allocated crude-oil import quotas to refineries that had no previous importing history, either because of size or distance from deep-water ports. Most of the new importers found it desirable to have an exchange agreement with large coastal refineries, which permitted an exchange of foreign for domestic crude suitable for their particular requirements.

According to the Conservation Committee of California Oil Producers, there were 36,915 producing crude-oil wells at the end of December, an increase of 632 over the previous year. During 1959, 988 new oil wells were completed, including 70 service wells, of which 477 were completed to heavy-gravity oil pools and 511 to light-gravity pools. Development drilling completions by area or region were: San Joaquin Valley, 608 wells; Coastal, 186 wells; and Los Angeles, 194 wells. Exploratory wells numbered 498, or 22 more than for 1958. Of these, 411 were dry holes and 58 were completed for oil, 1 less completion than for the prior year. Additions to crude-oil reserves were slightly more than 5 percent, but most of the gain resulted from extensions and revisions of previously discovered fields and pools, as only 4 percent of the increase was contributed by successful wildcats. There were 8 new oilfields discoveries, 12 successful new pool wildcats, 6 deeper pool tests, 1 shallower pool test, and 31 outposts drilled primarily to find oil.

Average crude-oil charge to California refineries increased by 20,000 barrels a day, or 2 percent above 1958. No new crude-distillation units were built, but refinery modernization changes increased crude-charging capacity by 35,000 barrels (30,000 barrels of this resulted from addition of a new catalytic cracking unit in a refinery in the San Francisco Bay Region). Total crude charging capacity decreased by 31,000 barrels owing to retirement of obsolete equipment; 11,000 barrels of this amount was accounted for in one Los Angeles basin refinery, and 14,000 barrels resulted from dismantling another southern California plant, which had been shut down for 5 years. At yearend only 3 percent of the State's crude capacity was shut down. Although little was done to increase crude capacity, numerous refiners added new units to raise yields of gasoline and light fuels and to improve quality. Such new units included catalytic crackers, reformers, hydrotreating, isomerization, alkylation and coking plants. Partly for plant efficiency and cost reduction, but also for alleviating air pollution, several large refineries installed carbon monoxide boilers in conjunction with their catalytic cracking units.

NONMETALS

Asbestos.—Group 7 chrysotile asbestos and shorts were shipped from the Phoenix mine, Napa County, to plastering contractors for use as a bonding agent. Late in the year the mine and mill were leased to a Colorado corporation and expansion of production facilities was planned. Although no asbestos was mined, considerable development work was done at the St. Thomas group, San Benito County, and the Third Chance property, Trinity County. An out-of-State company reported several thousand feet of diamond drilling and trenching at the Voorhees mine, Calaveras County, and discovery work was completed on the Mt. Eddy prospect, Siskiyou County. Geological exploration for asbestos in the Santa Rita Peak area of Fresno and San Benito Counties consisted of bulldozer work and auger drilling.

Barite.—Production of crude barite was more than four times that in 1958, and shipments rose 13 percent. Although most of the crude mineral was mined in the Nine Mile Canyon area, Tulare County, one mine each in Nevada and San Bernardino Counties also were sources of barite in 1959. One producer operated a grinding plant in Alameda County, another ground barite at Compton, Los Angeles County, and a third upgraded the mineral in a jigging plant in Inyo County and operated a grinding plant in Kern County. A Stanislaus County chemical plant and a Merced County grinder operated on company-produced barite received from Nevada. Nearly 99 percent of the total ground barite was used in compounding well-drilling muds, but small quantities were used in glass, as a filler in paints and rubber, as a component in asphalt emulsions, and for ballast in tractor tires.

Boron Minerals and Compounds.—The State produced the entire domestic supply of boron minerals—a very high percentage of world supply. These minerals were obtained either from bedded borate deposits in Inyo and Kern Counties or recovered from the brines of Searles Lake, San Bernardino County. Refined boron compounds were produced from the Kern County crude borates in refineries at Boron, Kern County, and Wilmington, Los Angeles County. Crude borates (colemanite, ulexite and probertite) were mined from underground deposits. A chemical plant in the San Francisco Bay area produced high-purity boron compounds from crude borates mined in Kern County. The quantity and value of production rose 17 and 20 percent, respectively, above 1958. In 1959, for the first time, borate solutions were used by the U.S. Forest Service and the California Forest Service in suppressing forest fires. The consumption of crude borates for this use was estimated at more than 3,000 tons.

Bromine and Bromine Compounds.—Two companies produced elemental bromine, one from saltworks bitterns at Newark, Alameda County, and the other from Searles Lake brine in San Bernardino County. The former plant converted the bromine to ethylene dibromide, which is widely used as an ingredient of fumigants for soil and for stored grain. Ethylene dibromide is also a constituent of antiknock fluid for gasoline blending, but for this purpose considerable quantities were imported from out of State. The Searles Lake bromine was sold to other chemical companies for manufacturing various compounds for the above-named purposes and other chemical and pharmaceutical uses. Total production for the year, on the equivalent elemental bromine basis, was 19 percent below 1958, and the average unit price was 4 percent below the previous year.

Calcium Chloride.—Crude liquid calcium chloride was recovered from the brines of Bristol Lake, San Bernardino County, in plants at Amboy and Saltus. A third plant (at Saltus) purchased the crude liquid and produced a flake product and refined liquid. The quantity outputs of both liquid and flake were below 1958 figures. The products were marketed in southern California, Nevada, and Arizona, and used primarily as fireproofing and hygroscopic agents. Prices were appreciably lower than in 1958.

Cement.—Total production of portland cement at 13 California plants rose 12 percent, and shipments gained 10 percent, compared with 1958. Southern California cement plants in Kern, Los Angeles, Riverside, and San Bernardino Counties shipped 25.6 million barrels of cement, compared with 22.3 million barrels in 1958. Northern California plants in Calaveras, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties shipped 18.0 million barrels compared with 17.3 million barrels in 1958. Bulk shipments increased to 36.4 million barrels from 32.6 million, and paper bag shipments totaled 7.2 million barrels compared with 6.9 million in 1958.

TABLE 7.—Finished portland cement produced, shipped, and in stock, and estimated consumption

Year	Active plants	Estimated capacity (thousand barrels)	Production (thousand barrels)	Shipments from mills			Estimated consumption (thousand barrels)	Stocks at mills Dec. 31 (thousand barrels)
				Thousand barrels	Value			
					Total (thousands)	Average per barrel		
1950–54 (average)	11	33,935	30,105	30,038	$82,319	$2.74	26,111	1,492
1955	11	37,173	35,450	35,084	103,794	2.96	31,643	1,929
1956	12	42,882	39,547	39,290	120,511	3.07	35,872	2,180
1957	13	50,150	38,371	37,731	117,852	3.12	33,388	2,956
1958	13	49,505	39,056	39,583	124,367	3.14	34,232	[1] 2,483
1959	13	51,555	43,635	43,635	138,506	3.17	38,648	2,480

[1] Revised figure.

Clays.—Output of clays and shale increased 14 percent in quantity and 13 percent in value, compared with 1958, owing to the demand for building materials by California's construction industry. Forty-seven percent of the total production was used in manufacturing brick, tile, and sewer pipes, 24 percent for cement, 22 percent for lightweight aggregate, and 7 percent for industrial uses, primarily refractories. Los Angeles, Solano, San Mateo, Ventura, and Riverside Counties supplied 60 percent of the nearly 2.25 million tons of miscellaneous clay mined in 1959. Production of fire clay and stoneware increased to 436,000 tons and was principally from Amador, Placer, and Riverside Counties. Kaolin was mined in Mono and Orange Counties, and ball clay was produced in San Bernardino County. Bentonite was produced in Inyo, San Benito, and San Bernardino Counties, principally for use in oil-well drilling muds. Inyo County also was the source of State output of fuller's earth. Gladding McBean Co.'s new $5 million automated vitrified clay-pipe manufacturing plant near Corona was in full operation during the year. Pacific Clay Product Co.'s refractories division at Ione, in Amador County, was acquired by Harbison-Walker Refractories Co.

Diatomite.—Diatomite was produced from open-pit operations in Santa Barbara County, three near Lompoc, and one near Santa Maria and one each in Napa and Kern Counties. Sales from Kern County included stockpile withdrawals. A high percentage of the total production was consumed in preparing filter aids, in manufacturing insulation, and as a filler in various products. Two producers sold or used their entire output for absorbents; two others prepared the mineral for pozzolan or lightweight aggregate. The increased quan-

TABLE 8.—Clays produced, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Alameda	(1)	(1)	33,887	$76,280
Amador	(1)	(1)	84,591	321,889
Contra Costa	(1)	(1)	69,531	104,035
Inyo	13,336	$66,678	(1)	(1)
Kern	63,651	226,927	64,879	158,414
Los Angeles	316,701	389,775	401,097	492,762
Madera	3,881	4,851	(1)	(1)
Mono	1,954	5,567	2,100	5,985
Orange	40,179	231,085	34,796	256,580
Riverside	372,608	913,290	385,230	1,037,237
San Bernardino	103,645	294,025	126,273	362,230
San Diego	38,324	38,699	29,600	30,900
San Joaquin	9,100	26,852	50,500	93,793
San Luis Obispo	8,120	10,150	9,750	12,187
Santa Barbara	7,538	7,538	16,428	16,428
Santa Clara	63,516	60,853	44,744	53,360
Sonoma	44,939	14,904	19,500	7,800
Tulare	5,400	4,000	6,750	6,750
Undistributed [1]	1,301,098	2,717,181	1,346,338	2,609,080
Total	2,393,990	5,012,375	2,725,994	5,645,710

[1] Alameda (1958), Amador (1958), Calaveras, Contra Costa (1958), Fresno, Inyo (1959), Madera (1959), Marin, Placer, Sacramento, San Benito, San Mateo, Santa Cruz, Solano, Stanislaus, Sutter, Ventura, and Yuba Counties included with "Undistributed" to avoid disclosing individual company confidential data.

tity of filter-aid material processed, compared with 1958, was responsible for the slightly higher average value of the total 1959 output.

Feldspar.—Dune sands of the Monterey peninsula were mined for their feldspar content. One company removed heavy minerals by magnetic separation and utilized the feldspathic sand in manufacturing glass. Another operator used froth flotation to remove the heavy minerals and to produce feldspar and silica concentrates. The plant products were blended and ground to consumer specifications and sold for use in manufacturing glass, sanitary ware, pottery and tile, and other ceramic products. Crude feldspar, mined by open-pit methods in San Bernardino County, was custom ground in Los Angeles County for ceramic and refractory use by the producer.

Fluorspar.—A relatively small tonnage of Acid-grade fluorspar was produced from crude mineral mined in the Clark Mountains, San Bernardino County. The finished fluorspar was shipped to a dealer in Ohio. The requirements by California industries for both Acid- and Metallurgical-grades were met by out-of-State producers.

Gem Stones.—Agate, jasper, rhodonite, obsidian, and onyx were gathered in California in substantial quantities by individual collectors, gem groups, and commercial producers. Increased interest was observed in petrified wood found in Kern and San Bernardino Counties and in marcasite obtained near Nipomo in San Luis Obispo County. San Bernardino County continued to be the area most frequently visited by collectors. Other gem materials, collected from 22 counties during the year, included quartz crystals from Inyo County, nephrite from Monterey County, jadite and benitoite from San Benito County, tourmaline and garnet from San Diego County, and californite from Siskiyou County.

Gypsum.—The output of crude gypsum and gypsite from open-pit operations in California set a new record of 1.7 million tons, a gain of 18 percent over the previous year. Mines in Kern County yielded nearly 787,000 tons for agriculture. A substantial quantity also was mined in Imperial County, primarily for use in manufacturing building products. Kings, Merced, Riverside, San Luis Obispo, Santa Barbara, and Ventura Counties also produced some crude gypsum. A 16,000-ton self-unloading ore-carrier[3] was being used by Gypsum Carriers, Inc., a Kaiser Gypsum subsidiary to transport gypsum from the Gulf of Lower California to the company's west-coast plants.

Iodine.—The Nation's entire output of crude iodine was obtained from waste oil-well brines of the Los Angeles Basin. A plant at Seal Beach used a continuous-recovery process, resembling the blowing-out process for the recovery of bromine, to produce crude iodine from brines obtained from wells in both Los Angeles and Orange Counties. A Compton plant used the batch silver process and produced various iodine compounds by treating brines from the Dominques field. In November this recovery plant was closed, but the company continued production of iodine products from purchased crude iodine.

Iron Oxide Pigments.—The production of iron oxide pigments was limited to an Emeryville (Alameda County) plant. Although most of the output was manufactured from steel scrap using sulfuric acid and caustic soda, some natural pigment was produced utilizing limonite from a company-leased deposit in Oregon.

Lime.—The production of lime included calcined dolomite at Natividad in Monterey County, lime in El Dorado, San Bernardino, and Tuolumne Counties, and for the first time the captive production of calcined dolomite at Newark in Alameda County. The dolomite calcined at Newark came from San Benito County. As a result, the State's lime output in 1959 rose to 358,000 tons valued at $5.8 million. Lime production in El Dorado County was slightly below that of the previous year. Demand for construction lime was appreciably greater during 1959. Losses were recorded in the quantity of lime produced for agricultural and refractory uses.

Lithium Minerals.—Recovery of crude dilithium-sodium phosphate from Searles Lakes brines, San Bernardino County, was appreciably greater than in 1958. The crude material was converted to finished lithium carbonate and marketed as such.

Magnesite and Magnesium Compounds.—A relatively small quantity of magnesite quarried from the Western deposit near Livermore, Santa Clara County, was sold to an Alameda County plant and converted to magnesium sulfate. Production and sales of all magnesium compounds, except magnesium sulfate, exceeded those of the previous year, as shipments for export more than offset production losses sustained as a result of the steel strike. Extraction plants in Monterey and San Mateo Counties produced magnesium compounds from sea water, using calcined dolomite and limestone. Much of the output from the Monterey County operation was converted to dead-burned magnesia and utilized by the producer in the form of refractory materials at an integrated steel plant. Plants operated in Alameda and San Diego Counties, respectively, extracted magnesium hydroxide and magnesium chloride from purchased saltworks bitterns. The Alameda plant utilized caustic-calcined dolomite in the process.

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[3] Rock Products, vol. 62, No. 4, April 1959, pp. 80–81.

Mica.—Sericite schist deposits in the Ogilby area, Imperial County, were idle in 1959. One operator discontinued operations indefinitely. The Hyalumsil claims near Quincy, Plumas County, yielded a few pounds of sericite from exploratory work, some of which was shipped to a prospective consumer in Fresno for experimental and laboratory tests. Imported scrap mica was ground and sold for use in paint; crude material received from South Dakota was prepared for a shingle and roofing-paper manufacturer, at a Los Angeles County plant.

Perlite.—Production of crude perlite declined 5 percent from 1958 figures, as only two quarries were active; however, sales of crude material rose 10 percent. Purchases of crude perlite by California expanding plants, much of which was quarried outside the State, increased slightly above those of the previous year. During 1959, nine expanding plants were in operation: six in Los Angeles County and one each in Contra Costa, Napa, and San Diego Counties.

Potassium Salts.—Production and sales of potassium compounds rose 12 and 29 percent, respectively, above 1958. A lower average unit value reflected the general price reduction effective since July 1958. The total output from Searles Lake brines, San Bernardino County, was by one producer who recovered muriate of potash (potassium chloride), part of which was converted to potassium sulfate. Although most of the production was sold for agricultural use, some of the muriate of potash was refined for chemical use. A relatively small tonnage of flue-dust accumulated at a Santa Cruz County cement plant was sold to the fruit industry for soil improvement because of its potassium sulfate content.

Pumice, Pumicite, and Volcanic Cinder.—Production of pumice, pumicite, and volcanic cinder increased to 574,000 tons, much of which was volcanic cinder mined to replenish stockpiles of railroad ballast material in San Bernardino and Modoc Counties and cinder produced in Lassen County for use in construction of county and U.S. Forest Service roads. The total output of railroad ballast from cinder deposits in Modoc, San Bernardino, and Siskiyou Counties was 322,000 tons, compared with 214,000 tons in 1958. Pumice and cinder produced for use as concrete aggregate increased to 111,000 tons, from 102,000 tons in 1958. Nearly 110,000 tons of cinder was mined for use in road construction. Considerable quantities of pumice and cinder boulders from Imperial, Lake, and Mono Counties were marketed for use as decorative landscape rock. Pumice and related volcanic materials were mined in Kern County for abrasives, paint, dental, and absorbent uses; in Madera County for pesticides; and in Mono County for scouring blocks. Pumice and cinder also were produced in Fresno, Inyo, and Shasta Counties.

Pyrite.—Production of pyrite was limited to the Iron Mountain (Hornet) mine, Shasta County, in 1959. Shipments exceeded those in 1958 due to increased sales to a Nevada copper-leaching plant for making sulfuric acid. The remaining consumption was principally by two Contra Costa County chemical plants, also for sulfuric acid. The resulting cinder produced at the California acid plants was sold for use in manufacturing quick-setting cements.

TABLE 9.—Pumice [1] sold or used in 1959, by counties

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Fresno			492	$4,000	492	$4,000
Inyo	2,299	$4,598	31,945	155,851	34,244	160,449
Kern			1,116	46,478	1,116	46,478
Lake	14,562	29,902	(2)	(2)	(2)	(2)
Lassen	(2)	(2)	(2)	(2)	82,807	167,505
Madera			8,070	101,312	8,070	101,312
Modoc	(2)	(2)	5,500	16,000	(2)	(2)
Mono	(2)	(2)	12,250	545,449	(2)	(2)
San Bernardino	(2)	(2)	1,125	13,500	(2)	(2)
Shasta	4,297	7,736			4,297	7,736
Siskiyou	169,522	306,904	37,077	128,879	206,599	435.783
Other counties [2]	245,939	645,632	40,103	155,908	236,672	1,238,886
Total	436,619	994,772	137,678	1,167,377	574,297	2,162,149

[1] Includes pumicite and volcanic cinder.

[2] Imperial and parts of Lake, Lassen, Modoc, Mono, and San Bernardino Counties are included with "Other counties" to avoid disclosing individual company confidential data.

Salt.—Common salt was harvested by solar evaporation from sea water in five coast counties and from dry-lake brines in two counties of the southern desert area. One of the producers also mined rock salt from a deposit in one of these desert areas.

Nearly 66 percent of State salt production was evaporated from sea water in the San Francisco Bay area. California's major producer operated plants in Alameda County on salt harvested from ponds in Alameda and San Mateo Counties and supplied crude salt to another salt company. The major company had expected production from Napa County in 1959 but encountered adverse weather conditions in 1955 and 1957 plus unforeseen physical difficulties at the site. The initial harvest from Napa County is now expected in 1961 and might exceed 100,000 tons. Total shipments and sales were above 1958, and only in one category (pressed blocks) was there even a slight decline. Although more than half of California salt production was consumed in the State, shipments were made to 12 other States, the Pacific Island possessions, Canada, Mexico, and 5 other foreign countries. More than 40 percent of the total output was consumed in making chlorine.

Sand and Gravel.—Production and value of sand and gravel in California reached a record 87.9 million tons and $108.9 million. The

TABLE 10.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Sand		Gravel		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54	20,896	$19,345	33,269	$29,020	54,165	$48,365
1955	25,507	26,857	39,372	39,963	64,879	66,820
1956	30,564	35,492	55,883	61,034	86,447	96,526
1957	32,789	34,134	46,194	52,896	78,983	87,030
1958	30,810	34,710	53,327	60,630	84,137	95,340
1959	34,101	41,583	53,844	67,326	87,945	108,909

demand for sand and gravel for structural use rose 4 million tons from 1958 and accounted for virtually all the increase. Total output from San Diego County was up nearly 2.4 million tons; and Fresno, Santa Clara, and Kern Counties gained over 1 million tons each, compared with the previous year. Construction and maintenance of State highways required more than 11.8 million tons of sand and gravel produced by State and county crews and contractors and by commercial producers. Demand for industrial sands for glass and sandblasting increased above 1958, but that for molding and engine sands declined. An appreciably higher tonnage of high-purity silica sand was processed and ground in Monterey County.

TABLE 11.—Sand and gravel sold or used by producers, by commercial and Government-and-contractor operations, and by uses

(Thousand short tons and thousand dollars)

Use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Glass	453	$1,917	499	$1,958
Molding	(1)	(1)	50	224
Building	15,602	18,061	17,430	21,848
Paving	7,622	7,448	8,881	9,932
Blast	187	564	202	796
Engine	85	166	55	177
Filter	164	76	----------	----------
Other	3,941	3,833	4,650	4,316
Total	28,054	32,065	31,767	39,251
Gravel:				
Building	17,641	24,144	20,091	29,463
Paving	18,705	20,875	20,061	24,739
Railroad ballast	224	223	297	318
Other	3,588	3,501	3,795	3,669
Total	40,158	48,743	44,244	58,189
Total sand and gravel	68,212	80,808	76,011	97,440
GOVERNMENT-AND-CONTRACTOR OPERATIONS [2]				
Sand:				
Building	9	15	14	15
Paving	2,747	2,630	2,320	2,317
Total	2,756	2,645	2,334	2,332
Gravel:				
Building	25	32	87	63
Paving	13,144	11,855	9,513	9,074
Total	13,169	11,887	9,600	9,137
Total sand and gravel	15,925	14,532	11,934	11,469
ALL OPERATIONS				
Sand	30,810	34,710	34,101	41,583
Gravel	53,327	60,630	53,844	67,326
Grand total	84,137	95,340	87,945	108,909

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes figures for States, counties, municipalities, and other Government agencies.

TABLE 12.—Production of sand and gravel in 1959, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alameda	7,787	$12,476	Orange	5,769	$6,040
Alpine	(1)	1	Placer	547	559
Butte	952	942	Riverside	2,167	3,546
Calaveras	119	382	Sacramento	4,658	7,268
Colusa	317	380	San Benito	198	178
Contra Costa	220	205	San Bernardino	6,311	6,259
Del Norte	336	359	San Diego	7,229	11,426
El Dorado	241	290	San Joaquin	1,903	2,704
Fresno	2,706	3,253	San Luis Obispo	834	957
Glenn	423	460	San Mateo	3	4
Humboldt	1,375	1,307	Santa Barbara	1,801	2,013
Imperial	511	479	Santa Clara	3,322	3,116
Inyo	140	161	Santa Cruz	762	1,075
Kern	2,592	3,079	Shasta	957	1,265
Kings	130	180	Sierra	114	110
Lake	614	551	Siskiyou	534	591
Lassen	38	38	Sonoma	1,527	1,610
Los Angeles	17,404	17,962	Stanislaus	717	761
Madera	205	196	Tuolumne	53	64
Mariposa	70	88	Ventura	2,434	3,662
Mendocino	517	566	Yuba	610	644
Modoc	500	510	Other counties [2]	6,941	8,919
Mono	190	235			
Monterey	1,047	1,919	Total	87,945	108,909
Napa	120	119			

[1] Less than 1,000 short tons.

[2] Includes Amador, Marin, Merced, Nevada, Plumas, San Francisco, Solano, Sutter, Tehama, Trinity, Tulare, and Yolo Counties, combined to avoid disclosing individual company confidential data.

Slag (Iron-Blast-Furnace).—An insulation company operated a plant for blowing slag wool on the slag dump of the Fontana blast furnaces, San Bernardino County. The company also crushed the slag for railroad ballast, and sized, dyed, and bagged the product for marketing as roofing granules and as outdoor decorative purposes.

Sodium Compounds.—The quantity and value of sodium compounds produced rose 11 and 8 percent, respectively, above 1958. Two plants at Searles Lake, San Bernardino County, produced soda ash (sodium carbonate) and salt cake (sodium sulfate) from the dry-lake brines. Glauber's salt also was produced at one of these plants. A plant at Bartlett recovered soda ash and sodium sesquicarbonate from the brines of Owens Lake, Inyo County. Crude borates mined in Kern County yielded byproduct salt cake at the producer's refinery near Boron, and anhydrous sodium sulfate at the company's Wilmington refinery, Los Angeles County.

Stone.—Despite a substantial reduction in the requirements of riprap for dams and levee projects during 1959, total stone production declined only moderately. The decline was offset somewhat by increased output of crushed stone for concrete aggregate, as road base material and of limestone quarried for use in cement and lime manufacture. The production of limestone and dolomite for metallurgical, agricultural, and refractory uses also was greater, as was the output of crushed marble for terrazzo. In the dimension stone category, the demand for flagstone was exceptionally favorable. Appreciable gains also were reported in the tonnages of dimension granite quarried for architectural use, crushed granite and basalt produced for concrete and roadstone, and slate. More than 328,000 tons of natural and artificially colored roofing granules was prepared from crushed stone and gravel.

TABLE 13.—Stone sold or used by producers, by uses

Use	1958		1959	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble..short tons..	48, 560	$628, 481	48, 042	$576, 338
Rough architectural............cubic feet..	[1] 72, 582	[1] 443, 630	[2] 37, 992	[2] 267, 742
Approximate equivalent in short tons..	6, 078	--------------	3, 160	--------------
Monuments and mausoleums...cubic feet..	(3)	(3)	45, 939	368, 276
Approximate equivalent in short tons..	(3)	--------------	3, 871	--------------
Flagging........................cubic feet..	11, 636	30, 911	41, 130	75, 443
Approximate equivalent in short tons..	1, 160	--------------	3, 384	--------------
Total dimension stone (quantities approximate, in short tons)..........	55, 798	1, 103, 022	58, 457	1, 287, 799
Crushed and broken stone:				
Riprap..........................short tons..	4, 535, 718	6, 041, 468	2, 988, 354	4, 791, 958
Metallurgical.......................do....	(4)	(4)	(4)	(4)
Concrete and roadstone..............do....	10, 248, 237	12, 871, 300	10, 508, 699	13, 458, 238
Railroad ballast....................do....	105, 802	115, 327	(4)	(4)
Agricultural........................do....	(4)	(4)	(4)	(4)
Chemical............................do....	12, 467	41, 426	(4)	(4)
Miscellaneous [5]...................do....	[6] 17, 465, 277	[6] 28, 172, 952	[7] 18, 578, 372	[7] 29, 551, 832
Total crushed and broken stone.....do....	32, 367, 501	47, 242, 473	32, 075, 425	47, 802, 028
Grand total (quantities approximate, in short tons)............................	32, 423, 299	48, 345, 495	32, 133, 882	49, 089, 827

[1] Includes dressed architectural and rough and dressed monumental stone.
[2] Includes dressed architectural and roofing slate.
[3] Included with "Rough architectural" to avoid disclosing individual company confidential data.
[4] Included with "Miscellaneous" to avoid disclosing individual company confidential data.
[5] Includes whiting substitute, filler, mineral food, poultry grit, stucco, roofing granules, filter beds, terrazzo, metallurgical, railroad ballast, agricultural, chemical (1959), and miscellaneous uses.
[6] Includes 11,794,819 short tons of limestone and oystershell used in cement valued at $14,949,555 and 557,088 tons of limestone used in lime valued at $1,471,946.
[7] Includes 12,886,476 short tons of limestone and oystershell used in cement valued at $14,485,668 and 776,884 tons of limestone used in lime valued at $2,142,830.

TABLE 14.—Production of stone,[1] 1959, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Alameda	979	$1, 004	San Bernardino	5, 335	$7, 643
Alpine	1	1	San Diego	1, 431	2, 357
Amador	(2)	44	San Joaquin	(3)	(3)
Butte	119	122	San Luis Obispo	371	971
Contra Costa	1, 864	2, 873	San Mateo	2, 130	2, 595
Del Norte	49	51	Santa Barbara	433	985
El Dorado	750	2, 297	Santa Clara	4, 317	4, 813
Fresno	53	133	Santa Cruz	1, 207	1, 597
Humboldt	112	98	Shasta	65	60
Imperial	33	25	Sierra	87	103
Kings	22	47	Solano	47	59
Lake	16	13	Sonoma	215	333
Lassen	50	69	Sutter	27	28
Los Angeles	2, 400	3, 828	Tehama	(3)	(3)
Mono	2	2	Trinity	643	549
Monterey	599	(2)	Tulare	219	208
Nevada	29	30	Tuolumne	181	800
Plumas	2	3	Ventura	401	797
Riverside	1, 055	2, 966	Other counties [4]	6, 879	11, 571
Sacramento	11	15			
			Total	32, 134	49, 090

[1] Includes stone used in cement and lime.
[2] Included with "Other counties" to avoid disclosing individual company confidential data.
[3] Less than 1,000.
[4] Includes Calaveras, Inyo, Kern, Madera, Marin, Mariposa, Mendocino, Napa, Orange, Placer, San Benito, San Francisco, Stanislaus, and part of Amador and Monterey Counties, combined to avoid disclosing individual company confidential data.

TABLE 15.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Limestone [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	2, 724, 342	$3, 420, 057	1, 923, 351	$2, 547, 821	12, 472, 285	$21, 075, 656
1956	3, 899, 350	5, 155, 292	1, 966, 581	2, 339, 318	14, 115, 070	22, 118, 105
1957	12, 744, 413	10, 564, 922	1, 952, 417	2, 431, 926	14, 102, 264	22, 511, 933
1958	3, 649, 390	5, 347, 679	1, 498, 912	1, 738, 570	14, 408, 695	22, 583, 791
1959	4, 343, 101	5, 432, 902	1, 772, 035	2, 727, 699	16, 136, 874	24, 383, 955

Year	Sandstone		Other stone [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	2, 937, 537	$4, 886, 507	4, 650, 806	$5, 234, 343	24, 708, 321	$37, 164, 384
1956	2, 917, 916	4, 833, 877	9, 684, 453	11, 662, 060	32, 583, 370	46, 108, 652
1957	4, 222, 211	6, 679, 968	8, 329, 954	11, 402, 340	41, 351, 259	53, 591, 089
1958	3, 933, 245	5, 687, 984	8, 933, 057	12, 987, 471	32, 423, 299	48, 345, 495
1959	2, 758, 317	4, 506, 303	7, 123, 555	12, 038, 968	32, 133, 882	49, 089, 827

[1] Excludes limestone and oystershell used in cement and lime as follows: 1955, 10,977,552 tons, $16,431.434; 1956, 12,259,540 tons, $17,354,910; 1957, 11,860,832 tons, $16,489,192; 1958, 12,351,907 tons, $16,421,501; 1959, 13,663,360 tons, $16,628,498.

[2] Includes light-colored volcanics, schist, serpentine, river boulders, and such other stone as cannot properly be classed in any main group; also marble (1955–59) and slate (1958–59).

Strontium Minerals.—A few tons of celestite mined from a deposit in the Fish Creek Mountains, San Diego County, were converted to various strontium compounds in the producer's Los Angeles chemical plant.

Sulfur.—Recovery of byproduct sulfur from oil-refinery gases was slightly lower than in 1958 but was roughly proportional to refinery crude throughput. Mainly as the result of continued modernization in two refineries, recovery in the San Francisco Bay region gained significantly. Refineries in the Los Angeles area still accounted for about 60 percent of California's recovered sulfur production but the yield was appreciably lower than in 1958. The drop may have resulted from greater selectivity of low-sulfur crude oils for cracking, fostered by Los Angeles County's new smog regulations.

Recovery of sulfur dioxide from stack gases at the Selby smelter in Contra Costa County was appreciably less than in 1958, presumably because the plant was inactive for part of the year because of a strike.

Sulfur ore was mined at five properties: two in Lake County and one each in Alpine, Inyo, and Kern Counties. Most of the shipments were from the Leviathan mine, Alpine County, where crude ore was transported to a Nevada copper-leaching operation for sulfuric-acid manufacture. All sulfur ore, other than that from the Leviathan mine, was produced for agriculture. Total shipments exceeded the 1958 figures, but the average sulfur content was less, resulting in a lower per-ton value.

Talc, Soapstone, and Pyrophyllite.—The tonnages of these minerals produced and shipped rose 14 and 20 percent, respectively, over 1958. Total direct sales to consumers, however, declined two-thirds from the previous year, owing principally to the use of substitute materials. Except for a few tons of crude talc mined at the Ganim property near Tower House, Shasta County, all of 1959 California talc production came from mines in Inyo and San Bernardino Counties. Pyrophyllite was mined at two deposits in Mono County, one in Inyo County, and three in San Diego County. Crude pyrophyllite from stocks previously mined at the Victorite property in San Bernardino County, was shipped to grinders. Two properties in El Dorado County and one in Los Angeles County yielded the entire State output of soapstone. Compared with 1958, demand for the ground minerals increased appreciably for use in ceramics and pharmaceuticals and as a filler in asphalt, paint, and rubber. Of the three minerals mined and ground, only talc was exported.

Vermiculite.—There was no activity at vermiculite prospects in the State during 1959. Plants in Sacramento and Los Angeles exfoliated crude minerals mined in Montana, and an Orange County plant processed vermiculite imported from Africa.

Water.—In August a southern California utility company began constructing a sea-water distillation pilot-plant at its power station near Oxnard, Ventura County. The 26-stage flash evaporater experimental unit will utilize nearly spent steam from the generating station turbines when in operation early in 1960. Late in the year, under a cooperative agreement with the California Department of Water and Power and the Office of Saline Water, U.S. Department of the Interior, plans were made to construct a plant at Point Loma, San Diego County, to experiment on desalting sea water, utilizing a reactor as a source of heat.

Several geothermal wells were drilled at The Geysers, Sonoma County, early in the year. A California utility company had acquired property in the geyser area and planned to use steam from three of the wells to serve a generating unit in the powerplant expected to be completed and in operation in May 1960. When operating at capacity the plant will transmit 12.5 megawatts continuously. The plant site has been designed so that a second unit of the same capacity can be easily installed when sufficient steam has been developed to supply a second turbine.

Wollastonite.—Shipments of wollastonite were made from the Midland area in Riverside County for use as ornamental stone and for test purposes. The new rock-wool plant at Blythe, utilizing wollastonite, was operated on a pilot basis during 1959.

METALS

Chromite.—Mining activity at chromite mines in California was at a standstill in 1959 due to the ending of the domestic purchase program in May 1958. A few tons of chromite ore, produced from the Lambert mine, Butte County in 1957, was processed at a grinding plant in the San Francisco Bay area for use in manufacturing glass containers.

Copper.—The 11-percent decline in copper output from 1958 was due at least in part to the mine, mill, and smelter strike that began August 10 and lasted 4 months. Only four mines in the State yielded more than 10 tons of copper for the year. Most of California's 1959 copper production was byproduct recovery from the treatment of tungsten ores mined in the Pine Creek area, Inyo County, or copper precipitate produced at the Iron Mountain massive pyrite operation, Shasta County. Lesser quantities of the metal were recovered from gold ores mined in El Dorado, Mariposa, Nevada, and Yuba Counties; lead and lead-zinc ores from Inyo County mines; and lead and silver ores produced in San Bernardino County.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Amador	1	1	62	$2,170	10	$9
Butte	(2)	2	40	1,400	3	3
Calaveras	2	2	167	5,845	26	23
El Dorado	3		299	10,465	(3)	(3)
Fresno		1	388	13,580	53	48
Humboldt	1		42	1,470	534	483
Inyo	10		227	7,945	(3)	(3)
Kern	9	(2)	(3)	(3)	240	217
Los Angeles		(2)	125	4,375	17	15
Mariposa	10	(2)	1,502	52,570	442	400
Mono	1		46	1,610	261	236
Nevada	3	5	1,950	68,250	(3)	(3)
Placer	1	4	279	9,765	31	28
Plumas	1	3	95	3,325	12	11
Riverside	1		1	35		
San Bernardino	5		(3)	(3)	(3)	(3)
Shasta	7	2	514	17,990	131	119
Sierra	9	9	21,784	762,440	3,975	3,598
Siskiyou	3	5	8,966	313,810	25,410	22,997
Trinity		2	72	2,520	7	7
Tuolumne	1	1	96	3,360	13	12
Undistributed [4]	5	5	109,486	3,832,010	141,737	128,279
Total	73	42	146,141	5,114,935	172,902	156,485

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador							$2,179
Butte							1,403
Calaveras							5,868
El Dorado			(3)	(3)	(3)	(3)	10,465
Fresno							13,628
Humboldt	22,500	$6,907					8,860
Inyo	(3)	(3)	442,300	$50,865	(3)	(3)	58,810
Kern							217
Los Angeles							4,390
Mariposa	100	31	(3)	(3)	(3)	(3)	53,001
Mono							1,846
Nevada			(3)	(3)	(3)	(3)	68,250
Placer							9,793
Plumas							3,336
Riverside							35
San Bernardino	2,600	798	(3)	(3)	(3)	(3)	798
Shasta	88,700	27,231	400	46	(3)	(3)	45,386
Sierra					1,200	$138	766,176
Siskiyou							336,807
Trinity							2,527
Tuolumne							3,372
Undistributed [4]	1,212,100	372,115	11,300	1,299	154,800	17,802	4,351,505
Total	1,326,000	407,082	454,000	52,210	156,000	17,940	5,748,652

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] From property not classed as a mine.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Includes Del Norte, Madera, Monterey, Sacramento, San Diego, San Joaquin, and Yuba Counties combined to avoid disclosing individual company confidential data.

Gold.—The 1959 output of recoverable gold dropped 21 percent from 1958 figures, but the percent of the total gold produced at placer operations remained unchanged from the previous year. A high percentage of the placer gold was recovered by bucketline dredges operated by the State's two major producers, one each in Sacramento and Yuba Counties. The former washed only about half as much gravel as in 1958, and the latter recovered less gold from a greater yardage

TABLE 17.—Gold production at placer mines, by classes of mines and methods of recovery [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (thousand cubic yards)	Gold recovered (troy ounces)
Surface placers:				
Gravel mechanically handled:				
Dredges:				
1950–54 (average)	28	37	59,774	163,598
1955	15	23	40,944	143,183
1956	12	19	36,709	131,529
1957	7	13	31,304	118,591
1958	11	15	27,598	136,021
1959	11	16	24,654	104,496
Nonfloating washing plants [3] [4]				
1950–54 (average)	22	22	48	2,081
1955	18	18	80	1,865
1956	18	22	2	1,624
1957	4	21	12	1,549
1958	4	15	1	872
1959	3	11	2	1,201
Gravel hydraulically handled:				
1950–54 (average)	16	----------	150	604
1955	7	----------	116	230
1956	6	----------	9	101
1957	6	----------	11	85
1958	6	----------	7	166
1959	3	----------	4	50
Small-scale hand method: [5]				
1950–54 (average)	50	----------	102	1,838
1955	28	----------	94	1,182
1956	26	----------	79	1,029
1957	32	----------	36	1,283
1958 [6]	39	----------	49	1,177
1959 [6]	22	----------	26	2,017
Underground placers:				
Drift:				
1950–54 (average)	14	----------	5	241
1955	14	----------	5	153
1956	11	----------	4	164
1957	6	----------	3	109
1958	5	----------	(7)	27
1959	3	----------	(7)	9
Grand total, placers:				
1950–54 (average)	130	----------	60,079	168,362
1955	82	----------	41,239	146,613
1956	73	----------	36,803	134,447
1957	55	----------	31,366	121,617
1958	65	----------	27,655	138,263
1959	42	----------	24,686	107,773
1848–1959	----------	----------	(8)	67,871,962

[1] For historical data by years, see Minerals Yearbook, Review of 1940, p. 219.

[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[3] Includes commercial rock plants and tungsten mines that produced byproduct gold from gravels; byproduct gold is included with gold recovered.

[4] Includes all placer operations using power excavator and washing plants both on dry land; when the washing plant is a movable outfit, it is termed "dry-land dredge."

[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.

[6] Includes gold recovered by electrostatic separation; combined to avoid disclosing individual company confidential data.

[7] Less than 1,000 cubic yards.

[8] Data not available.

treated. In 1959, 42 placer properties were active, several old tailing piles were reworked, numerous prospects yielded gold, and 17 sand and gravel operations recovered byproduct gold at washing plants.

Only four lode mines produced gold ores yielding more than 1,000 ounces each. Nearly 500 tons more lode material from 34 fewer mines were treated to recover 19 percent less gold than in 1958.

TABLE 18.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals[1]

Year	Mines producing[2]		Material sold or treated[3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1950–54 (average)	168	130	418	296,501	$10,377	932,548	$844
1955	130	82	305	251,737	8,811	954,181	863
1956	116	73	281	193,816	6,784	938,139	849
1957	118	55	204	170,885	5,981	522,288	472
1958	107	65	139	185,385	6,489	188,260	170
1959	73	42	142	146,141	5,115	172,902	156
1848–1959	-------	--------	(4)	105,581,805	2,397,467	118,744,692	96,684

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	622	$307	10,466	$3,143	6,669	$2,061	$16,732
1955	613	457	8,265	2,463	6,836	1,682	14,276
1956	859	730	9,296	2,919	8,049	2,205	13,487
1957	945	569	3,458	989	2,969	689	8,700
1958	749	394	140	33	51	10	7,096
1959	663	407	227	52	78	18	5,748
1848–1959	636,301	206,861	262,878	52,238	149,484	35,282	2,788,532

[1] Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes retreated; tungsten ore; and ore, old tailings, slag, flue dust, and pyritic ore residue shipped to smelters during calendar year indicated.

[2] Excludes itinerant prospectors, "snipers," "high graders," and others who gave no evidence of legal right to property.

[3] Does not include gravel washed.

[4] Data not available.

Iron Ore.—Despite a prolonged steel strike during the last half of 1959, production of usable iron ore rose 14 percent and shipments were up 8 percent, compared with 1958. Output of direct-shipping-grade ores continued to decline and more lower grade ores were upgraded at concentrators. As in 1958, only two iron mines in the State were active—the Eagle Mountain, Riverside County, and the Iron Age, San Bernardino County. Both yielded some direct-shipping ore, and concentrators were operated at each property. Shipments were principally to Fontana blast furnaces, although some direct-shipping ore was sold to cement plants. The port of Stockton received more than 500,000 tons of iron ore and concentrate, valued at nearly $5 million. The ore, from Nevada mines, was exported to Japan. During the latter part of 1959 a major Nevada iron ore producer conducted a magnetometer survey at an iron prospect in Butte County, Calif. and planned about 10,000 feet of core drilling. The program had not been completed at yearend, and no reports were issued.

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	25,687	4,769	----	----	----
Old tailings	73	12	----	----	----
Total	25,760	4,781	----	----	----
Cyanidation: Ore	8,156	25,295	----	----	----
Total recoverable in bullion	33,916	30,076	----	----	----
Concentration and smelting of concentrates: Ore [1] [2]	[3] 3,656	109,776	1,205,200	6,100	5,200
Direct smelting:					
Ore	302	25,452	32,100	442,800	150,300
Copper precipitates	----	10	88,700	300	----
Old tailings	494	1,442	----	4,800	500
Total	796	26,904	120,800	447,900	150,800
Placer	107,773	6,146	----	----	----
Grand total	146,141	172,902	1,326,000	454,000	156,000

[1] Includes tungsten-ore concentrate.
[2] Combined to avoid disclosing individual company confidential data.
[3] Includes gold recovered as "natural gold."

TABLE 20.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	59	137,673	37,533	31,657	1,600	3,700	3,100
Silver	2	137	21	2,511	----	400	----
Copper and tungsten ore [2]	4	[3] 794	205	109,070	1,228,800	----	1,900
Lead	5	485	9	4,405	400	124,100	1,100
Lead-zinc	2	1,555	33	17,649	6,500	320,700	149,400
Total	72	140,644	37,801	165,292	1,237,300	448,900	155,500
Other lode material:							
Copper precipitates	1	66	----	10	88,700	300	----
Old tailings	(4)	926	567	1,454	----	4,800	500
Total	1	992	567	1,464	88,700	5,100	500
Total lode material	73	141,636	38,368	166,756	1,326,000	454,000	156,000
Gravel (placer operations)	42	(5)	107,773	6,146	----	----	----
Total all sources	115	----	146,141	172,902	1,326,000	454,000	156,000

[1] Detail will not necessarily add to total, because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Tungsten-ore tonnage not included.
[4] From property not classed as a mine.
[5] 24,686,350 cubic yards. Does not include material washed at commercial gravel plants to produce 1,182 ounces of byproduct gold and 113 ounces of byproduct silver included in placer totals.

Iron and Steel.—The steel strike (July 15–October 26) at Fontana—California's only integrated steel plant—undoubtedly reduced planned production of pig iron and steel appreciably. Despite this fact, production and shipments of pig iron actually increased 5 and 6 percent, respectively, over 1958. Consumption of pig iron increased 5 and 29 percent at steel and iron foundries, respectively. These percentages were indicative of foreign imports of pig iron by major iron foundries in the State during the strike. In some instances stocks of foreign pig iron at plants represented 3-month requirements or more. In January the fourth and largest blast furnace was placed in operation at the Fontana plant, increasing annual pig iron (hot metal) capacity to 1,997,800 tons. Two new batteries of 45 coke ovens were later put into operation, raising the number to 315 and coke production capacity to 1,502,000 tons per year. At the same location, the company's oxygen-steelmaking operation was started February 1st. These facilities shortened the time of steelmaking sufficiently to raise the annual ingot capacity to 2,933,000 tons of steel. At Niles, Alameda County, a fourth open-hearth furnace was completed, the capacity of which required new fabricating facilities to be completed in 1960. The company's planned completion of a blast furnace was thus delayed until 1961. Steel production exclusive of steel foundries in the State was supplied by 30 open-hearth furnaces, seven electric furnaces, and three oxygen-steel furnaces.

Some pig iron was shipped into California from Geneva, Utah, and consumed in numerous foundries. Early in the year one of the largest shipments of steel reinforcing bars ever imported on the Pacific Coast was received at Encinal Terminals, Alameda County. The 4,500 tons of steel bars, made in West Germany, were imported for a Santa Clara County steel-supply company.

TABLE 21.—Consumption of ferrous scrap and pig iron in thousand short tons

Year	Total scrap used	Pig iron used	Year	Total scrap used	Pig iron used
1950–54 (average)	2,417	1,146	1957	2,656	1,437
1955	2,778	1,223	1958	2,127	1,280
1956	2,789	1,431	1959	2,280	1,379

TABLE 22.—Consumption of ferrous scrap and pig iron, by types of furnaces and miscellaneous uses, in thousand short tons

Ferrous scrap and pig iron charged to—	1958	1959	Ferrous scrap and pig iron charged to—	1958	1959
Steel furnaces:[1]			Miscellaneous uses:[3] Scrap	39	53
Scrap	1,763	1,868			
Pig iron	1,119	1,171	Total scrap	2,127	2,280
			Total pig iron	1,280	1,379
Total	2,882	3,039	Grand total	3,407	3,659
Iron furnaces:[2]					
Scrap	325	359			
Pig iron	161	208			
Total	486	567			

[1] Includes open-hearth, electric furnaces, and basic oxygen process.
[2] Includes cupola, air, and blast furnaces; also direct castings.
[3] Includes rerolling, copper precipitation, nonferrous, and chemical uses.

Iron and Steel Scrap.—Ferrous scrap consumption in the State increased 7 percent over 1958. This was more than double the increased output of steel ingots and steel used for castings—excluding steel castings produced by independent foundries. Scrap purchases were up 5 percent; and totaled 60 percent of consumption. Steel furnaces used 82 percent of the scrap consumed, iron furnaces 16 percent, and miscellaneous consumers 2 percent. Los Angeles and San Francisco prices for all grades of scrap were well sustained during the year and closed at or near the year's high. Los Angeles No. 1 Heavy-Melting scrap closed the year at $41 per long ton; San Francisco, at $40.

Lead.—Mine production of recoverable lead rose 62 percent from 1958. More than 97 percent of the total came from ores mined in Inyo County. Mines in this county were not only credited with the entire increase but more than offset losses sustained by inactivity at properties in other counties. The principal producers were the Santa Rosa and Defense mines.

The State's only primary lead smelter, in Contra Costa County, reduced lead ores and concentrates, chiefly from foreign sources.

Manganese.—Shipments of Metallurgical-grade manganese ore and concentrate, under the Government carlot program, were 10 percent greater, even though the program ended August 5. One less mine was active than in 1958, and shipments averaged slightly less in manganese content. The total production came from seven mines in Imperial County, three in San Bernardino County, two in Riverside County, and one each in Humboldt, Kern, Lake, Mendocino, Plumas, San Luis Obispo, Stanislaus, and Tehama Counties. Low-grade manganese ores mined in Imperial, Stanislaus, and Tehama Counties were shipped to an Arizona concentrator for upgrading. The State's only DMEA exploration contract for manganese ore, in Riverside County, was terminated in March.

Mercury.—Although California mercury production and shipments declined 25 percent from 1958, mines in the State supplied 55 percent of the Nation's output. There were 59 operators at 37 active mercury properties, compared with 72 operators and 48 active mines in 1958. Expiration of the domestic purchase program on December 31, 1958, undoubtedly was the chief factor in lower production, fewer ship-

TABLE 23.—Mercury produced, by methods of recovery

Year	Furnaced[1]		Retorted		Unclassified[2] 76-pound flasks	Total		Operating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks		76-pound flasks	Value[3]	
1950–54 (average)	74,599	6,647	2,981	412	126	7,185	$1,485,024	26
1955	122,937	8,671	5,982	1,077	127	9,875	2,867,206	49
1956	76,801	6,991	9,312	1,971	55	9,017	2,343,699	71
1957	115,134	13,722	10,806	2,228	561	16,511	4,077,887	57
1958	130,560	20,307	10,471	1,594	464	22,365	5,122,927	48
1959	107,072	15,685	12,034	1,271	144	17,100	3,889,908	37

[1] Includes ore and mercury from dumps not separable.
[2] Includes mercury recovered from miscellaneous dump material, placer, and cleanup operations.
[3] Value calculated at average price at New York.

ments, and loss of interest in mercury-mining activities. Four mines—one each in Lake, San Benito, San Luis Obispo, and Sonoma Counties, each with a yield of more than 1,000 flasks—were the source of 81 percent of State production and shipments in 1959. Only 9 operators in California produced more than 100 flasks each during the year.

Molybdenum.—Molybdenite and powellite concentrates were recovered in the treatment of tungsten ores mined in the Pine Creek area, Inyo County. The ores were selectively mined for high molybdenum and copper, and the resulting molybdenum concentrates were exported.

Platinum-Group Metals.—Platinum was recovered as a byproduct of dragline dredging for gold on the American and Yuba Rivers in Sacramento and Yuba Counties, respectively.

Rare-Earth Minerals.—A bastnasite concentrate was recovered from ore mined at the Mountain Pass barite-fluocarbonate deposit in the Ivanpah Mountains, San Bernardino County. The concentrate, containing an average of 68-percent rare-earth oxides, was produced by flotation, leaching, and roasting. The quantity and value of shipments were only half the 1958 figures. Exploration for xenotime (yttrium phosphate mineral) at the U-Thor claims in the Pinto Mountains, Riverside County, a few miles southeast of Twenty-nine Palms, yielded some development rock, but no ore was shipped or treated.

Secondary Nonferrous Metals.—The consumption of nonferrous scrap in California during 1959 was estimated at 310 million pounds valued at nearly $32 million. The quantity consumed was about 7 percent of iron and steel scrap consumption and 10 percent above the 1958 figures. Lead scrap made up approximately 42 percent of the total, copper 29 percent, and aluminum 15. The remaining 14 percent consisted of zinc, antimony, magnesium, nickel, and tin scrap, collectively. Consumption by secondary plants of the three principal nonferrous-scrap metals was confined largely to the Los Angeles area, which consumed 84 percent of the total lead and copper and 97 percent of the total aluminum. Over 18,000 individuals were employed in the secondary smelting and refining of nonferrous metals, in the rolling, drawing, and extrusion plants, and in the nonferrous foundries combined.

Silver.—Silver production was 8 percent below that of 1958. Approximately 75 percent of the total output in 1959 was recovered as a byproduct of tungsten, lead-zinc, and lead ores mined in Inyo County. As in 1958, 96 percent of the total silver recovered was derived from lode mines, principally as a byproduct of other metals; the remaining 4 percent was as a coproduct of gold at placer properties.

Tungsten.—The Pine Creek mine and mill, in Inyo County, was the State's only active tungsten operation during 1959. Considerable exploration and development work was done during the year, resulting in more than 60,000 tons of development rock. Late in the year the operator began the addition of two new processing steps to the plant flowsheet that would permit production of high-purity ammonium paratungstate.

In October the owners of the Strawberry tungsten mine, Madera County, announced plans to reopen the mine and mill, and construct an ammonium paratungstate plant. The company expressed interest in the fused-salt method of producing tungsten, developed by the Federal Bureau of Mines at its Reno Metallurgy Research Center.

Uranium.—Production of commercial uranium ore came from two properties, one each in Kern and Lassen Counties. The tonnage shipped was 14 percent above that in 1958; however, the average U_3O_8 content was nearly 50 percent less. Both producers shipped to a Utah processing plant.

Zinc.—Recoverable zinc output increased 53 percent. The lode mines of Inyo County were credited with 98 percent of the State total; the lead-zinc ores from the Santa Rosa mine were the principal source. Ores from five gold mines, plus one old tailing pile, and one lead property, accounted for all zinc production outside Inyo County.

Other Metals.—Work at zircon prospects was confined to drilling and sampling operations at a placer deposit near Lincoln, Placer County. The exploration yielded a small quantity of zircon concentrate, none of which was marketed. Some exploration for titanium minerals was done at the Live Oak placer property, Whitney Canyon area, Los Angeles County, in preparing for planned production in 1960.

Activity at cobalt-nickel properties in Del Norte, Imperial, and San Diego Counties was confined to assessment work. A nickel prospect in Mendocino County was the site of limited geological exploration.

REVIEW BY COUNTIES

Alameda.—Sand and gravel output dropped to about the 1957 production level, due entirely to reduced demand for paving material as a result of major freeway completions in 1958. However, there was increased production of sand and gravel in 1959 for building construction and railroad ballast. The major sand and gravel producers were in the Pleasanton, Niles, and Fremont areas. Basalt was obtained from Leona quarry, near Oakland, for riprap, concrete aggregate, and fill use. Sandstone and miscellaneous stone quarried in the Castro Valley, Hayward, Niles, and San Leandro areas were used principally for fill. Artificially colored roofing granules were prepared at Emeryville, using gravel from a Sacramento County source. Fire clay was mined for foundry use at the Tesla clay deposit near Livermore; pits near Niles were the source of miscellaneous clay used in manufacturing brick and tile.

Crude salt was harvested from several thousand acres of ponds by solar evaporation of sea water and washed at four plants in the county. The State's leading salt producer refined the crude salt at Newark and sold crude to another nearby salt company. Bitterns from the Newark plants were piped to a chemical plant in the area for extraction of magnesium hydroxide and bromine. At the latter plant dolomite from San Benito County was burned to make quicklime used to precipitate the magnesium hydroxide. A synthetic gypsum was produced in the process.

TABLE 24.—Value of mineral production in California, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Alameda	$19,060,749	$20,527,931	Sand and gravel, salt, magnesium compounds, stone, lime, bromine, clays.
Alpine	(1)	(1)	Sulfur ore, stone, sand and gravel.
Amador	969,733	1,396,203	Sand and gravel, clays, coal (lignite), stone, gold, silver.
Butte	2,819,647	3,159,252	Natural gas, sand and gravel, stone, gold, chromite, silver.
Calaveras	12,902,098	15,094,715	Cement, stone, sand and gravel, clays, gold, tungsten, gem stones, silver.
Colusa	1,287,214	1,578,377	Natural gas, sand and gravel.
Contra Costa	3,714,637	3,675,555	Stone, natural gas, sand and gravel, peat, clays.
Del Norte	571,803	410,731	Sand and gravel, stone, gold.
El Dorado	2,206,428	3,148,051	Stone, lime, sand and gravel, soapstone, gold, lead, silver, zinc.
Fresno	110,711,093	90,814,355	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, clays, gold, pumice, mercury, silver.
Glenn	5,228,404	7,973,023	Natural gas, sand and gravel.
Humboldt	1,949,399	1,721,542	Sand and gravel, natural gas, stone, manganese ore, copper, gold, silver, gem stones.
Imperial	2,800,689	[2] 3,347,714	Gypsum, manganese ore, sand and gravel, stone, pumice, gem stones.
Inyo	6,957,054	8,710,106	Tungsten, molybdenum, sodium carbonate, talc and pyrophyllite, boron minerals, copper, stone, sand and gravel, pumice, silver, perlite, lead, clays, zinc, sulfur ore, gold, gem stones.
Kern	333,300,306	351,593,897	Petroleum, boron minerals, natural-gas liquids, natural gas, cement, stone, sand and gravel, gypsum, sodium sulfate, clays, salt, pumice, gold, sulfur ore, gem stones, diatomite, uranium ore, manganese ore, carbon dioxide, silver.
Kings	14,007,533	12,705,146	Natural-gas liquids, petroleum, natural gas, gypsum, sand and gravel, stone, mercury.
Lake	1,168,849	945,993	Sand and gravel, mercury, pumice, pumicite, and volcanic cinder, sulfur ore, stone, manganese ore.
Lassen	(1)	278,481	Volcanic cinder, stone, sand and gravel, uranium.
Los Angeles	288,666,777	235,457,378	Petroleum, natural-gas liquids, sand and gravel, natural gas, stone, cement, iodine, clays, soapstone, gold, gem stones, silver.
Madera	1,421,103	1,484,470	Natural gas, stone, sand and gravel, pumice and pumicite, copper, clays, gold, silver.
Marin	1,817,869	1,478,499	Stone, sand and gravel, clays, mercury.
Mariposa	406,035	158,926	Sand and gravel, gold, stone, silver, copper, lead, zinc.
Mendocino	1,172,143	769,465	Sand and gravel, stone, manganese ore, gem stones.
Merced	840,220	1,387,326	Sand and gravel, gypsum.
Modoc	710,372	899,699	Sand and gravel, peat, pumice and volcanic cinders, gem stones.
Mono	656,323	1,009,385	Pumice, sand and gravel, pyrophyllite, clays, stone, gold, silver.
Monterey	27,533,946	38,379,498	Petroleum, lime, magnesium compounds, sand and gravel, stone, natural gas, feldspar, salt, mercury, gem stones, gold.
Napa	856,768	861,769	Stone, sand and gravel, diatomite, asbestos, perlite, mercury, gem stones.
Nevada	1,256,093	1,247,906	Sand and gravel, gold, stone, barite, silver, lead, zinc.
Orange	132,425,593	109,718,068	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays, stone, salt, iodine, peat.
Placer	1,071,768	1,140,315	Sand and gravel, clays, stone, gold, silver.
Plumas	2,184,969	218,818	Manganese ore, sand and gravel, gold, stone, silver.
Riverside	34,715,893	37,408,611	Iron ore, cement, sand and gravel, stone, clays, manganese ore, gypsum, peat, wollastonite, petroleum, gem stones, gold.
Sacramento	[3] 17,082,410	17,440,123	Natural gas, sand and gravel, gold, clays, stone, platinum, silver.
San Benito	8,257,884	8,280,925	Cement, petroleum, mercury, stone, natural gas, sand and gravel, clays, gem stones.

See footnotes at end of table.

TABLE 24.—Value of mineral production in California, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
San Bernardino	[3] $76,101,411	$85,193,487	Cement, boron minerals, stone, sodium carbonate, sand and gravel, sodium sulfate, potassium salts, salt, talc, lithium minerals, lime, calcium chloride, clays, petroleum, iron ore, bromine, volcanic cinder, manganese ore, rare earths, barite, natural gas, feldspar, gem stones, silver, gold, copper, lead, zinc.
San Diego	9,212,941	14,489,604	Sand and gravel, stone, magnesium compounds, salt, clays, pyrophyllite, gem stones, strontium minerals, gold, silver.
San Francisco	(1)	280,062	Stone, sand and gravel.
San Joaquin	4,091,912	3,983,052	Sand and gravel, natural gas, clays, stone, gold, gem stones.
San Luis Obispo	10,729,526	9,326,038	Petroleum, stone, sand and gravel, natural-gas liquids, mercury, natural gas, gypsum, clays, manganese ore, gem stones.
San Mateo	11,452,612	13,109,357	Cement, stone, salt, magnesium compounds, petroleum, clays, natural gas, sand and gravel.
Santa Barbara	98,830,858	89,894,897	Petroleum, diatomite, natural-gas liquids, natural gas, sand and gravel, stone, mercury, clays, gypsum, gem stones.
Santa Clara	28,419,631	29,425,563	Cement, stone, sand and gravel, mercury, clays, masonry cement, magnesite, petroleum, gem stones.
Santa Cruz	8,988,120	10,069,197	Cement, stone, sand and gravel, clays, potassium salts, gem stones.
Shasta	1,676,197	2,137,663	Sand and gravel, pyrites, stone, copper, gold, volcanic cinder, asbestos, talc, silver, lead, zinc.
Sierra	648,498	979,641	Gold, sand and gravel, stone, silver, gem stones, zinc.
Siskiyou	1,699,383	1,363,752	Sand and gravel, pumice and volcanic cinder, gold, silver, gem stones.
Solano	8,752,846	8,762,038	Natural gas, clays, sand and gravel, stone.
Sonoma	3,097,232	2,675,786	Sand and gravel, mercury, stone, natural gas, clays, gem stones.
Stanislaus	727,005	[2] 795,170	Sand and gravel, clays, manganese ore, stone, mercury.
Sutter	688,365	662,411	Natural gas, sand and gravel, stone, clays.
Tehama	486,945	[2] 596,603	Sand and gravel, natural gas, manganese ore, stone.
Trinity	2,354,765	1,366,674	Sand and gravel, stone, mercury, gold, silver.
Tulare	2,289,728	3,125,868	Natural gas, sand and gravel, barite, stone, petroleum, clays.
Tuolumne	1,065,455	1,257,348	Stone, lime, sand and gravel, gold, gem stones, silver.
Ventura	181,137,209	151,783.379	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, clays, gypsum.
Yolo	(1)	(1)	Sand and gravel, natural gas.
Yuba	5,239,854	3,648.167	Gold, sand and gravel, clays, platinum, silver, copper, zinc.
Undistributed [4]	[3] 1,944,767	4,690,990	
Total [5]	1,500,367,000	1,424,039,000	

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[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Excludes value of manganese and low-grade manganese ores sold and blended at Government low-grade stockpiles for future beneficiation.

[3] Revised figure.

[4] Includes gem stones, mercury, and gold for unknown county production, and value indicated by footnote 1.

[5] Total adjusted to eliminate duplicating value of clays and stone.

At another Newark plant crude gypsum from Nevada mines was calcined and processed into wallboard and other gypsum products. A 50,000-square-foot warehouse was under construction at Fremont for distribution of gypsum products of a major gypsum company.

The California State Land Commission reserved the State mineral rights in denying a cement company permission to dredge oystershell from tide and submerged lands of the San Francisco Bay that were earmarked for expansion of the Metropolitan Oakland International

Airport. The company had dredged oystershell in other parts of the bay for use as a source of lime.

At Emeryville, open-hearth steel furnaces were closed by the steel strike, but the Niles plant continued operating when the union local signed a contract extension. The latter plant was forced to delay completion of its blast furnace when a fourth open-hearth required additional fabricating facilities. Grinding plants in Berkeley, Emeryville, and Oakland processed crude barite for drilling muds and paint. The Berkeley plant also custom ground various other nonmetallic minerals received from mines outside the county. Another Emeryville plant produced the State's entire output of iron-oxide pigments, most synthetically manufactured.

Alpine.—The Leviathan mine, near Markleeville, was the source of crude sulfur ore used in making sulfuric acid at the producer's copper-leaching plant in Nevada. Shipments were 4 percent below the previous year, owing to curtailed copper output at company smelters as a result of a labor strike.

Nearly 900 tons of sand and decomposed granite were produced and used for road maintenance in the county by crews of the California Division of Highways.

Amador.—The Ione area was the source of sand produced for glass manufacture and of clays dug for use in refractory brick, stoneware, pottery, and other heavy clay products. Quartzite was quarried in the area for use of refractory brick. County road crews prepared paving gravel and crushed miscellaneous stone for road maintenance. Some dimension stone, used for building and rubble, was obtained from a quarry near Volcano.

California's only active lignite mine, near Ione, yielded an appreciably larger tonnage than in 1958. The crude material was processed at Buena Vista to recover montan wax and other byproducts. The Rancheria drift mine near Sutter Creek, and several small stream-gravel washing plants, yielded a few ounces of gold. A lode prospect near Pioneer was the source of gold ore from which gold and silver were recovered.

Butte.—Dry-natural-gas production from fields in the county rose nearly 15 percent above 1958. The Wild Goose field was the State's third largest producer, with a 17-percent increase in volume output. The Durham and Perkins Lake fields also had increased output, but the yield from the Chico and Llano Seco fields dropped below the 1958 figures. The three wells in the Schohr Ranch field, shut in during the previous year, produced in 1959.

Pits near Chico, Gridley, and Oroville were the principal sources of sand and gravel, dug for structural and paving use, and for railroad ballast. Stone was quarried and crushed for riprap and paving by crews and contractors of State and county road agencies.

Stream gravels on the south fork of the Feather River yielded a few ounces of gold and silver. Old tailings on the El Dorado property at Feather Falls were reworked to recover gold and silver. A small tonnage of chromite ore, produced at the Lambert mine in 1957, was shipped to a grinding plant near San Francisco. A magnetometer survey and a core drilling program were carried out on an iron-ore prospect in the Sterling City area, but no ore was mined.

Calaveras.—Production and shipments of portland cement from the five-kiln plant at Kentucky House rose above 1958. Shipments were made to consumers in California, Nevada, and Oregon. Some cement was exported. In September the plant became a division of Flintkote Co. During the year new bulk-loading facilities were added to allow simultaneous loading of three bulk-cement trucks, two sack-cement trucks, and one railroad car. Pits in the Campo Seco, San Andreas, and Vallecitos areas supplied most of the sand and gravel prepared for building and paving. Blast sand was produced near Campo Seco. Glass-sand production near Camanche fell short of the 1958 output. Limestone was quarried for cement near San Andreas. Quarries near Mokelumne Hill and Altaville were sources of miscellaneous stone prepared for roofing granules. County and State road crews produced and utilized granite and miscellaneous stone for highway maintenance. Clay was mined near San Andreas for use in making cement, and fire clay dug from a deposit near Valley Springs was consumed in manufacturing sewer pipe and other heavy clay products.

Relatively small quantities of gold and silver were obtained from placer properties, output was chiefly from a non-floating washing plant at Camanche and several small-scale hand operations at various locations. Some gold and silver was recovered from a few tons of ore produced at the Western Quartz mine north of Murphys. The remaining tungsten concentrate stocks of the Moore Creek mine, near Salt Springs Reservoir, were sold to various buyers in the San Francisco Bay area. This concentrate had been produced from ore mined in previous years.

Colusa.—Natural-gas production was substantially the same as in 1958. The higher output from the Arbuckle field almost offset declines in production from the Compton Landing and Princeton fields. A new operator in the Arbuckle gasfield area discovered a fault-block accumulation in the northeast part of the field adjacent to producing gas wells. By the end of the year this operator had completed three other substantial gas wells in the field.

Commercial preparation plants in the Colusa and Williams areas and State and county road crews produced more than 300,000 tons of sand and gravel. Local requirements for paving gravel and a greater demand for building sand and gravel were responsible for the increased output.

Contra Costa.—Basalt from a quarry near Orinda, sandstone from quarries near Richmond and Pacheco, and miscellaneous stone from a Clayton quarry were the sources of stone used for riprap, concrete aggregate, and roadstone. Production was slightly below 1958 because of a decline in requirements for highway construction. Sand dug from pits in the Antioch and Cowell areas was prepared for paving mix and mortar and used for fill. These areas also supplied some gravel used for fill. Miscellaneous clays obtained from deposits near Port Costa and Richmond were used in manufacturing common brick. Crude gypsum imported from Baja California, Mexico, was calcined in an Antioch plant and used in manufacturing various building products. Some crude gypsum was sold for use as a cement retarder. Crude perlite from a Nevada mine was expanded in this plant. Refractories were made in the Pittsburg area from clays mined in other counties.

Much of the natural-gas production credited to the county came from the Rio Vista field. The discovery well in the Los Medanos area, completed in 1958, was reworked in 1959, resulting in a shallower pool discovery. In December the operator extended the area to the northwest with a well completion, which also resulted in discovery of a new pool. The Willow Pass area, 2 miles to the southeast, was discovered by a second operator, and the well was completed in May. Initial discovery was followed by both shallower and deeper pool discoveries during development operations. This operator also made a new pool discovery with a September well completion, which extended the productive limits of the area. These completions helped raise natural-gas production about 3 percent above the previous year. Petroleum refineries either recovered molten sulfur or supplied hydrogen sulfide gas to chemical plants for recovery of elemental sulfur from which sulfuric acid was produced. Waste stack gases of the Selby lead smelter yielded liquid sulfur dioxide, some of which was converted to sulfuric acid. Sulfuric acid also was made from pyrites mined in Shasta County at plants near Richmond and Nichols. The resulting cinder was sold to cement producers. The pyrite producer also prepared copper compounds from scrap in a Martinez plant. Peat-dredging operations in the San Joaquin River delta yielded a relatively large tonnage of reed-sedge peat which was packaged and sold in bulk as a soil conditioner.

Del Norte.—Sand and gravel produced from pits near the Klamath and Smith Rivers and by crews and contractors of State and county road agencies was nearly 100,000 tons less than in 1958. Stone output also declined. Stone was produced for road construction and maintenance by State and county crews and contractors.

Gold was recovered from bench gravel in a nonfloating washing plant near Gasquet.

El Dorado.—Stone output rose 750,000 tons. More than half the production was quarried by crews and contractors of State and county road agencies and by contractors for the Sacramento Municipal Utilities District. Quarries near Auburn, Cool, Diamond Springs, and Shingle Springs were sources of limestone for use in manufacturing lime and glass, in sugar refining, as metallurgical flux, as a filler in asphalt and fertilizer, and for whiting and roofing granules. Quick and hydrated lime was produced at Diamond Springs, primarily for use by steel producers, construction and chemical industries, and for other industrial uses. Although most of the output was consumed in California, shipments were made to other States and to Canada. Some dimension stone was quarried near Placerville for use as rubble and in building construction. Sand and gravel from the Placerville and Lake Tahoe areas was prepared for structural and paving use, principally by county, State, and Federal agencies. Slate quarried at Chili Bar was prepared as roofing granules and slate flour. Sales of slate flour increased substantially.

Soapstone mined at the Pacific Minerals deposit northeast of Latrobe and at a prospect south of Shingle Springs was shipped to grinders in the San Francisco Bay area. The Hazel Creek lode-gold mine yielded much of the county's recoverable gold and silver, and all lead and zinc produced. Gold and silver also were recovered from gold ore mined at the Yellow Jacket property near Kelsey.

Fresno.—Petroleum production declined nearly 4 percent, compared with 1958, yet drilling activity was high. Coalinga, with 91 notices to drill, led all other fields. Completion of 14 shallow wells in the Temblor formation increased slightly the productive limits of this field to the northwest. In the Guijarral Hills field, one of the more active fields in the county, continued development of the Gatchell pool resulted in a southwest extension of the productive limits. In addition to 4 new wells drilled in the zone, 11 wells which formerly produced were deepened. Initial productive rates varied, owing to permeability of the sand. A new fault-block discovery was made in the Helm field northeast of production and a March well completion extended productive limits to the southwest. A measure of success was attained in the Jacalitos field by redrilling and recompleting an old well. Air was used as the circulating medium, rather than conventional liquid-type fluid, and the production rate increased from 1 to 75 barrels of oil per day. Wet gas was processed in natural-gasoline plants at Burrel and Coalinga, and production of natural-gas liquids increased nearly 18 percent, compared with 1958. Dry natural-gas output from the only gas well in Fresno County (Gill Ranch field) rose 30 percent above the previous year.

Sand and gravel output rose to 2.7 million tons, owing to extensive building and road-construction activities in the county. A new operation near Sanger produced a substantial tonnage for concrete aggregate. Output from preparation plants in the Coalinga, Fresno, Friant, and Pinedale areas was also appreciable. Dimension granite was quarried near Academy for architectural use, and crushed stone and decomposed granite were obtained from quarries near Clovis, Fresno, Friant, and Sanger for use as concrete aggregate and for driveways and fill. Miscellaneous clay was dug near Fresno and used by the producer in manufacturing brick. Nearly 500 tons of pumice was mined from the South Dome deposit east of Friant and used as concrete aggregate. A plant at Fresno custom-ground crude barite for producers and processors outside the county.

Most of the county's gold and silver output was byproduct recovery at six sand-and-gravel-washing plants. Some gold, however, was obtained by working bench gravel at a placer property near Auberry. Cinnabar ore from the Little Mercy group near Mendota was retorted, yielding a few flasks of mercury.

Glenn.—A new pool discovery was made in the Bounde Creek gasfield when a well completion was made in January as a dual-zone gas well. In September the productive limits of this field were extended about 1¼ miles northeast and a deeper pool discovery was made. The Artois area, 6 miles northeast of Willows, was discovered by a November gas-well completion; and the Rancho Capay area, 7 miles northeast of Orland, was discovered when a gas well was completed in August. Thirteen gas wells were completed during 1959 in the Willows-Beehive Bend gasfield, the most active field in California's District No. 6. However, only one new pool discovery was made during the year, a shallower pool from a February well completion.

A gas well completed in March extended productive limits to the southwest, and an extension well on the west side of the field was completed in June. Productive limits in the southeast part of the field were extended one-half mile north by an October gas-well completion.

Gravel was produced at Wyo for railroad ballast, and sand and gravel from pits in the Orland and Willows areas was prepared for building and paving. Nearly 200,000 tons of sand and gravel was required for road construction and maintenance by State and county road agencies.

Humboldt.—Production of natural gas from the county's only field, the Eureka gasfield, dropped to 53 percent of the 1958 output.

The quantity of sand and gravel produced was virtually the same as in 1958. Sources for these materials were principally pits in the Arcata and Fortuna areas, where they were prepared for building and paving use. In 1959 more than 1 million tons of sand and gravel was required in public-works projects of city, county, State, and Federal agencies. Several stone quarries in the county were worked to obtain riprap and fill material for use on breakwater and river embankments and in road construction.

Manganese (carbonate) ore from the Queens Peak deposit near Garberville was shipped to a Government stockpile. The Copper Bluff mine near Hoopa was the source of all recoverable gold, silver, and copper credited to the county in 1959. Nearly 600 feet of tunnels and raises were completed in this mine during the year as part of the development program. At Horse Mountain a new operator was developing an open-pit copper mine and had a mill under construction. The completed plant was to consist of two 500-ton-per-day units. Company personnel reported the copper concentrate produced would be shipped to Japan.

Imperial.—The Fish Creek Mountains deposit yielded a substantial quantity of crude gypsum, which was consumed in the producer's gypsum-products plant at Plaster City. Most of the more than 500,000 tons of sand and gravel produced in the county was obtained by crews and contractors of the county road agency, the Imperial Irrigation District, and the Federal Bureau of Reclamation. Commercial sand and gravel preparation plants in the Brawley and El Centro areas supplied the material for concrete aggregate. Granite and decomposed granite were quarried near Calexico, Plaster City, and Winterhaven for riprap and fill. Near Calipatria, pumice was mined for landscape rock and concrete aggregate.

Seven manganese properties in the Palo Verde Mountains were the source of oxide ores and concentrates representing more than 50 percent of the entire State output. All shipments were made to a Government stockpile. A few tons of low-grade ore from one of these mines was shipped to an Arizona mill.

Inyo.—Lode mines in the county yielded all molybdenum and tungsten concentrates and a high percentage of the recoverable gold, silver, copper, lead, and zinc produced in the State during 1959. Tungsten ores from properties in the Pine Creek area near Bishop were the source of the molybdenum and tungsten, and most of the gold, silver, and copper. Lead-silver-zinc ores from the Santa Rosa mine southwest of Keeler, the Defense and Emley mines east of Darwin, and the Queen of Sheba mine east of Ballarat added appreciably to the total gold, silver, copper, lead, and zinc credited to the county. Silver and lead were also recovered from ore mined at the Rosario property east of Furnace Creek and the Sunny Slope prospect near Death Valley Junction.

Soda ash and sodium sesquicarbonate were produced from Owens Lake brines in a plant at Bartlett. About 60 percent of the State's production and shipments of crude talc came from deposits in the county, chiefly the Gold Hill and Sugar Loaf areas of the Panamint Range and the areas near Big Pine, Big Springs, Keeler, and Tecopa. Some of the crude mineral was ground in plants at Laws and Keeler. Talc deposits near Cerro Gordo Peak and in the Gold Hill area of Death Valley were scenes of exploration and development work consisting chiefly of shaft sinking, drifting, and diamond drilling. The Laws plant also custom ground crude barite. Crude borate minerals were obtained from underground mines in Corkscrew Canyon and near Shoshone and shipped to the producer's mill and refinery in Kern County.

Commercial production of sand, gravel, and stone rose above 1958 figures; however, a lesser volume of public-works projects accounted for a drop in total output of these materials. Nearly 32,000 tons of pumice was mined near Little Lake, most of which was used as concrete aggregate, pozzolanic cement, and insulation. The Van Loon deposit near Bishop also yielded several thousand tons of pumice for concrete aggregate. Crude perlite mined from the Fish Springs quarry was sold to various customers outside the county. Bentonitic clay mined from the Ibex deposit near Tecopa was sold to a Los Angeles grinding plant; those obtained from pits near Death Valley Junction were used in pharmaceuticals and ceramics. Fuller's earth from an Olancha property was prepared for use in insecticides or used as a decolorizer. Sulfur ore produced at the Crater mine in the Last Chance Range was sold for agricultural use.

Kern.—Drilling activity for oil and gas increased in the county. The Kern River field, with 121 new wells, was the most active, followed by Midway-Sunset, Buena Vista, and North Tejon. Abandonment operations increased—88 by former producers and 178 dry holes. Exploratory drilling resulted in the discovery of a new gasfield in the central part of San Joaquin Valley, a gas accumulation at a shallow depth northeast of McKittrick, and a new oil-bearing structure southeast of Maricopa. Deeper pools and extensions were found in a number of other fields.

A new pool of limited extent was discovered north of the nearest production in Bellevue field. A new accumulation in the upper Stevens sand was found in the East Gosford area of Canfield Ranch field, and the abandoned West Gosford area was reactivated by the completion of a well in September. A new gasfield was discovered 20 miles northwest of Bakersfield in January. The classification of San Emidio Nose, discovered in 1958, was changed from a county area to a field when productivity was established in March. Drilling activity in North Tejon field increased about 50 percent, and production more than tripled that of 1958. The presence of gas in shallow water wells in the region of Trico gasfield had been noted for many years. Until salvage operations were begun in the southern part of the field, such gas was allowed to escape to air. The operator installed a two-stage compressor and facilities for separating, recovering, and metering the gas accompanying the water produced. In October the recovery project was extended to a second water well, and by yearend the recovery of natural gas was slightly over 2 million cubic feet per day.

The increased drilling activity for oil and gas paid off in 1959 in that, contrary to the statewide trend, output of crude oil rose 9 percent above 1958, and the quantity increase for county-produced natural gas was 28 percent, compared with 5 percent for the State. Wet gas was processed in 16 natural-gasoline plants (including 1 new plant in 1959) and 2 cycling plants. Output of natural-gas liquids was 11 percent higher than in 1958. A natural-gasoline plant at Taft began producing liquid carbon dioxide in November.

The leading domestic producer of boron compounds mined crude borates from an open pit near Boron. These borates and those received from company mines in Inyo County were refined at nearby facilities or further processed before shipment to the producer's refinery in Los Angeles County. Byproduct sodium sulfate was produced in the processing of crude borates at the Boron plant. Some crude or partially refined borates were sold to chemical companies and exported. Lesser quantities were consumed as an aid in combating forest fires and as an additive in weed-killing agents. Crude salt was harvested from dry-lake brines by solar evaporation at a Saltdale plant and shipped to various consumers in the Los Angeles area.

Shipments of portland cement from plants at Monolith and Mojave were at a much higher level than in 1958. Both plants shipped to customers in California, Nevada, and Arizona; the Monolith plant also shipped to Oregon and Utah. Both plants operated 5 kilns; Monolith used a wet process and Mojave a dry process. Air separators and dust collectors were installed on finished grinding units at the Monolith plant during the year. Stone output in the county was virtually unchanged from 1958 except for the larger tonnage of limestone required for cement manufacture. Sand and gravel production increased more than 1 million tons, a gain of 68 percent over 1958. About 72 percent of the total output was consumed in asphalt and cement paving projects.

Agricultural gypsite produced from deposits near Lost Hills, McKittrick, Taft, and Maricopa totaled nearly 787,000 tons, almost half the entire tonnage of gypsum and gypsite mined in the State during 1959. Clays mined near Monolith were used in manufacturing cement. Miscellaneous clay produced near Mojave was consumed in pottery and as filler in rubber and linoleum; clay near McKittrick and Boron was used as an absorbent and a constituent in drilling muds. More than 1,000 tons of pumice was mined from the Calsilco claims between Mojave and Inyokern and prepared for use in abrasives and paint and as an absorbent. A new sulfur-ore producer shipped from a deposit near Taft to an Oildale plant, where the crude mineral was used in preparing soil conditioners. A plant near Button Willow processed diatomite mined outside the county for company use.

Two sand and gravel producers operated washing plants east of Bakersfield, near the Kern River, and recovered a few ounces of byproduct gold and silver. Five lode-gold mines in the Randsburg area, and two a few miles south of Mojave, yielded virtually all the county's recoverable lode gold and silver. The Yellow Aster mine south of Randsburg was the principal producer. California's most consistent producer of uranium ore, the Little Sparkler mine near Miracle Hot Springs, shipped its output to an out-of-State processor. One shipment of manganese ore was made from the Magna deposit near Randsburg to a Government stockpile. Crude barite from a mine in Tulare County was ground for well-drilling muds, glass and paint.

Kings.—The abandoned Harvester gas area was reactivated with the successful completion of two wells southeast and east, respectively, of the original discovery well. The productive limit of Dudley Ridge gasfield was extended westerly in October with the completion of a well flowing from several perforated intervals.

A new oil discovery in December west of the Dagney production area extended the boundary of the Pyramid Hills field. Crude oil was processed in a refinery near Hanford, and wet gases in natural-gasoline plants near Avenal. Natural-gas production (wet and dry) rose more than 40 percent above 1958 figures in comparison with petroleum and natural-gas-liquid outputs, which dropped 4 and 3 percent, respectively.

The Avenal area was the source of over 100,000 tons of gypsite mined and prepared for agriculture. Crews and contractors of county, State, and Federal agencies produced sand, gravel, and stone at various locations in the county and used the materials for road base and fill. Aggregate for cement and asphaltic concrete was obtained principally from producers in Fresno and Tulare Counties.

Cinnabar ore mined from the Little King (Fredanna group) claims near Parkfield was furnaced and ore from the Dawson pit near Avenal retorted to recover mercury. Exploration and development work completed at the Little King claims in 1959 included 200 feet of tunnels and about 2,000 feet of rotary drilling.

Lake.—Building construction and road projects required increased quantities of sand, gravel, and crushed stone, compared with 1958. Most of these materials were obtained from the Clear Lake area, which also was the location of increased production of volcanic cinder used for concrete aggregate.

Ore from the Abbott mine in Grizzley Canyon near the Colusa County line was furnaced, yielding over 1,000 flasks of mercury, which was shipped to buyers and brokers. This mine was one of California's four major mercury mines and the only active mercury property in the county during 1959. The Sulfur Bank mine, on the eastern arm of Clear Lake, was the source of a relatively small tonnage of sulfur ore used as a soil aid. The Seward (Auschwitz) property near the S-Bar-S Ranch southwest of Kelseyville was reactivated after development work in 1958. The 1959 mine output was sold as agricultural-grade sulfur. Manganese ore from the Toy Young property a few miles north of Nice was shipped to a Government stockpile.

Lassen.—Output of volcanic cinder increased substantially over 1958, owing to the quantities produced for road base and surfacing by the

Lassen County Road Department and the U.S. Forest Service. Cinder for concrete aggregate was mined commercially near Susanville. Granite was quarried in the same area for use as dimension building stone and for curbing. Sand, gravel, and crushed stone production was limited to requirements of county, State and Federal agencies for road construction and fill.

Uranium ore from the Cornelia C No. 2 mine was shipped to Salt Lake City, Utah, for processing. This mine had been a producer in 1957.

Los Angeles.—Crude-oil production was second only to that in Kern County. Nearly half the State's active refineries were in the county, most of the cracking and reforming capacity, and nearly one-third of the natural-gasoline plants. Considerable exploratory drilling for oil was done in the west side of Los Angeles basin during 1959. Seventeen deep tests were drilled around the edge of Inglewood field and the old Los Angeles City, Salt Lake, and Beverly Hills fields. The wells were drilled by nine different operators, and all were in residential areas. None of the wells was drilled to a depth of less than 5,000 feet and four were more than 10,000 feet deep. An apparently important discovery was made in the Culver City area west of the northerly limits of Inglewood field. A small accumulation of oil was discovered east of Rosencrans field. Wilmington was the most active field, with the most wells drilled for oil development, waterflooding for secondary recovery, and to combat subsidence. Measurements made by the Long Beach Harbor Department and the U.S. Navy in late December indicated that subsidence had been arrested in a 1,400-acre area near the southwest end of the Naval Shipyard, which overlies the area of most intense waterflooding. Subsidence apparently had been substantially reduced over an additional 2,300 acres, including portions of the Naval Shipyard and downtown Long Beach. Waste oil-well brines of the Los Angeles Basin (largely from within the county) were used to produce iodine and iodine compounds. Although most of these brines were pumped to an Orange County plant for iodine recovery, a Compton plant processed the brines to produce various iodine compounds until it closed indefinitely in November. Refineries in the Los Angeles-Long Beach area recovered hydrogen sulfide from byproduct gases. Two plants converted the gas to molten sulfur, and others piped it to nearby chemical plants for conversion to sulfur or sulfuric acid.

Despite a 2.8-million-ton drop in sand and gravel output from 1958, sources in the county yielded nearly 20 percent of the State total, more than twice that of any other county. Preparation plants at Azusa, Sun Valley, and Irwindale each produced more than 1 million tons of sand and gravel during the year. Specialty sands for molding, blast, engine, and other industrial uses were obtained and prepared in the El Segundo, Torrance, and Walteria areas. Stone production rose nearly 500,000 tons above 1958, owing to the output from quarries on Santa Catalina Island, which was used for breakwater and jetties, and to the decomposed granite quarried near Montebello for road base. The Palos Verdes and Saugus areas were principal sources of dimension stone produced for building construction and flagging. A Los Angeles cement company used company-produced gypsum from

Nevada and cement clinker purchased from other companies to produce finished portland cement. Another company installed new bulk-loading equipment at its Long Beach deep-water cement-distribution facility, which received cement from a company-owned plant in San Bernardino County. Miscellaneous clay mined near Santa Monica, Torrance, Los Angeles, Compton, Van Nuys, and Castaic was used in manufacturing building brick and tile. A deposit near San Fernando yielded clay consumed as a filler in fertilizer. Soapstone was obtained from the Katz property near the Hauser Ranch in Serra Pelona Valley and ground in Los Angeles for asphalt filler. One manufacturer of gypsum products processed crude material from its Nevada property in a South Gate plant, where a new plastermill and increased wallboard-making facilities were installed during the year. Another producer of gypsum products imported the crude mineral from Mexico for processing in a Long Beach plant and sold some crude for use as a cement retarder. Grinding plants at Compton and Terminal Island ground company-produced crude barite, and a Los Angeles plant custom-ground feldspar. Crude vermiculite mined in Montana was exfoliated for insulation and plaster in the producer's Los Angeles plant, and six other plants in the county expanded crude perlite from mines in California and Nevada. At Los Nietos a grinding plant processed imported scrap mica for a paint manufacturer and ground mica from South Dakota for use in roofing materials.

A sand and gravel preparation plant near Montebello recovered placer gold and silver as byproducts in its operation. Itinerant prospectors worked stream gravels at various locations in the county to recover relatively small quantities of gold and silver. Two steel companies in Torrance and two in Los Angeles produced ingots and finished steel products. One Torrance plant operated open-hearth facilities; the other three plants operated electric furnaces.

Madera.—Natural-gas production from the county's three producing fields dropped 6 percent below 1958. A high percentage of the 1959 output came from two operators at the Gill Ranch field.

Sand and gravel output in the County declined from 1958 primarily because of greater use of sand and gravel produced in Fresno County. Principal operations in Madera County were the preparation plants near Chowchilla and Madera. These plants supplied local requirements for aggregate used in building and paving. The higher stone output was credited largely to the quantity of granite produced in driving the power tunnel for the Mammoth Pool project. This granite was crushed and used for concrete aggregate in the tunnel. Dimension granite was quarried and dressed near Raymond for architectural and monument uses. More than 26,000 tons of granite from county quarries was crushed by contractors for highway construction. Approximately 8,000 tons of pumice and volcanic ash was produced from deposits near Friant and prepared for use in pesticides and as concrete aggregate. Clays dug near Fresno were used in manufacturing building brick.

Copper ore from the Jesse Belle mine northeast of Daulton was the sole source of recoverable copper and lode gold and silver in the county. Exploration and development work completed at this mine during the year included raises, winzes, drifts, and more than 1,000 feet of diamond drilling. One company recovered a few ounces of gold and silver during dredging operations on the San Joaquin River near Friant.

Marin.—Crushed basalt produced near Novato and sandstone quarried and crushed near San Rafael were the principal materials for road base and concrete aggregate. Much of the riprap produced from the McNear quarry, in the San Rafael area, was barged up the Sacramento River and used at flood-control projects. Sand and gravel plants at Novato and Point Reyes supplied local requirements for aggregate used in building and paving. Shale quarried at Point San Pedro, due east of San Rafael, was used in manufacturing brick and expanded for lightweight aggregate.

The Edwards mine on the Bently Ranch and the Gambonini deposit on the Brackett property east of Marshall were the sources of cinnabar ore retorted to produce mercury.

Mariposa.—Completion of major road-construction projects accounted for a drop in sand and gravel output. Pits near Groveland and Mariposa were the chief sources of these materials in 1959. Dimension mariposite stone was quarried near Coulterville and used in building construction and for decorative purposes. Slate from the Aqua Fria slate quarry near Mariposa was used for flagging and building stone, and the Mt. Bullion quarry, in the same area, was the source of slate for roofing and flagging.

Although 10 lode-gold properties in the county contributed to the total recoverable lode gold and silver, the Red Bank and Specimen mines near Bagby, and the Hasloe mine in Gentry Gulch southwest of Greeley Hill, were the principal producers. Placer mining was limited to a few small-scale operations by prospectors.

Mendocino.—Sand and gravel production declined slightly below 1958 because of lower requirements for commercial building and paving. Much of the output was consumed in projects of county and State road agencies and the Federal Bureau of Indian Affairs. The principal sand and gravel preparation plants were in the Ukiah, Willits, Fort Bragg, and Manchester areas. Stone was quarried and crushed for road construction by Government crews and contractors.

The Foster Mountain manganese mine, west of Willits, yielded manganese ore, which was shipped to a Government stockpile. Near Leggett a nickel prospect under option was extensively explored by trenching and drilling. The operator reported that the option was terminated before yearend, and all geological and engineering information released to the property owners.

Merced.—Sand and gravel output increased slightly above 1958 and was obtained principally from deposits near Los Banos, Merced, and Snelling. These materials were used in the county for concrete aggregate and roadstone, and in highway construction and maintenance projects of county and State agencies. Gypsite quarried near Los Banos was prepared for use in conditioning alkaline soils.

A grinding plant in Merced processed company-produced crude barite from Nevada and bentonite mined in San Bernardino County as constituents in well-drilling muds. Some of the bentonite was prepared for special cement and chemical uses.

Modoc.—Sand and gravel was produced from pits near Alturas for local commercial use. Crews and contractors of county and State road agencies also produced sand and gravel for road construction and paving projects. Volcanic cinder mined near Ainshea Butte for railroad ballast, and cinder produced for use on U.S. Forest Service roads, comprised a high percentage of the total output of this material. The H. P. Free deposit near Tionesta was the source of 5,500 tons of pumice used as concrete aggregate and in cleaning compounds.

Peat moss was recovered from a bog in Jess Valley and trucked to Likely, where the producer processed the material for sale as a soil-improvement agent.

Mono.—Pumice was mined from deposits in the Mono Crater area and marketed as landscape material called "Featherrock." Some of the material was sawed at the Lee Vining mill and sold for scouring blocks. The Bishop and Benton areas were sources of pumice mined and prepared for acoustical plaster and lightweight aggregate. The county's entire output of sand and gravel was used in structural and paving projects by county and State road agencies. Some stone was quarried for riprap by a contractor for the California Division of Highways. Pyrophyllite, obtained from the Pacific and Colton mines near White Mountain, was ground by one producer in a Laws plant for use as a carrier in insecticides. The Little Antelope Valley clay deposit near Casa Diablo was the source of more than 2,000 tons of kaolin sold for use in whiteware and as a filler in paint, paper, and plaster.

Gold ore mined at the Chemung property near Bridgeport contained recoverable gold and silver. Some promising tungsten claims were located near the entrance to Yosemite Park at the north end of Tioga Lake. Assays on samples were reported at 1.0 to 1.5 percent WO_3 and 3 to 4 percent molybdenum. A Canadian company was to begin a drilling program in the spring of 1960.

Monterey.—San Ardo was the most active oilfield during 1959. All but 5 of the 20 wells completed were in the Lombardi pool of the Campbell area. After one dry hole, a new pool discovery was made in February approximately 8 miles northwest of King City in the Monroe Swell area. During 1959 the well produced over 10,000 barrels of oil. A new field discovery, which might prove to be of considerable importance, was made about 5 miles south of King City in December. On the last day of the year, the same operator completed a second well approximately 330 feet south of the discovery well in the same zone interval. The new discovery was designated the King City area. Crude-oil production was slightly greater than in 1958, but the volume of wet gas produced and processed was down 7 percent.

Quick and hydrated lime was produced in a plant at Natividad from limestone and dolomite quarried nearby. Although the lime was prepared for chemical and industrial uses, manufacturing refractories, and the building trades, most of the plant product (dolomitic lime) was consumed in the producer's sea-water processing plant at Moss Landing to recover magnesium hydroxide, which was calcined to produce magnesia. The resulting magnesia and chromite from the Philippine Islands were utilized in manufacturing refractories. The prolonged steel strike adversely affected production from the refractories and magnesia plants. Another plant at Moss Landing recovered crude salt from sea water by solar evaporation and sold the mineral locally for use in icing refrigerator cars.

Government crews and contractors produced and used a substantial percentage of the county's output of sand and gravel. The Pacific Grove, Seaside, and Castroville areas were sources for engine and molding sand and an appreciable tonnage of blast sand. A company at Pebble Beach ground dune sand for foundry, brick, abrasive, and other uses. A comparatively large tonnage of decomposed granite and miscellaneous stone was quarried in the county for use as road base and fill material in local and military projects. Limestone and dolomite quarried near Salinas were prepared for use as roofing granules and landscape rock. The combined recovery and sales of feldspathic sand and feldspar concentrate from dune sands near Pacific Grove were 7 percent above 1958. The feldspathic and silica sands and concentrates were consumed in manufacturing glass, sanitary ware, refractories, and other ceramic products.

A few flasks of mercury were retorted from ore mined at the Patriquin open-pit mine near Parkfield. A sample ore shipment to a smelter from the Ancona (Brewery) mine, in Brewery Gulch about 5 miles east of Cape San Martin, contained recoverable gold.

Napa.—Basalt near Napa and stone from the Pope Valley area were quarried and prepared for use as riprap, concrete aggregate, and road base. The total stone output, which rose above 1958, offset much of the drop in sand and gravel production. The principal sand and gravel preparation plants were in the Napa and Pope Creek areas. Diatomaceous silica was quarried near Napa and prepared for use in pozzolanic cement in a Napa Junction plant, which also thermally expanded shale for lightweight aggregate. The shale was obtained from the operator's quarry in Solano County.

The Phoenix mine near Napa was the State's largest active asbestos deposit and the only source of chrysotile asbestos in 1959. The Alvo quarry and expansion plant at St. Helena prepared perlite for plaster and concrete. Some crude perlite was shipped to an out-of-State consumer.

Four operators worked the James Creek gravels, using placer methods to recover mercury. Source of the metal was part of the Oat Hill mine dump, which had washed into the creek bottom. Ore was produced from the Oat Hill mine by three operators who used retorts to recover several flasks of mercury each.

Nevada.—The total output of sand and gravel was slightly lower than in 1958, owing to lesser requirements for paving gravel by contractors for the California Division of Highways. However, the output of an operator near the site of the Winter Olympics in Squaw Valley was double that in 1958. An operator at Truckee prepared a substantial tonnage of sand and gravel for concrete aggregate. Sand and gravel produced near Grass Valley was used in building and paving and in preparing drainage areas. Miscellaneous stone quarried in the same area was consumed in road construction. Crude barite from the Spanish mine near Nevada City was ground in the producer's Merced County plant.

Except for free-gold mineral specimens taken from the Red Ledge property (a former chromite producer) near Washington, the output of gold, silver, lead, and zinc came essentially from cleanup operations, retreatment of old tailings, and recoveries from mine ore dumps in the Grass Valley-Nevada City area. The entire holdings of Empire Star Mine Co., Ltd., in the same area, were sold at public auction late in the year. Except for output from one dragline operation near French Corral, all placer gold and silver recoveries were made by itinerant prospectors and miners using small-scale hand equipment.

Orange.—In September a new oilfield discovery was made 5 miles east of San Juan Capistrano. Nevertheless, crude-oil production dropped 6 percent below 1958 and wet-gas volume declined 5 percent. Wet gas was processed in six natural-gasoline plants; total volume of output was 2 percent under that of the previous year. Crude iodine was recovered from waste oil-well brines of the Los Angeles basin in a Seal Beach plant. Only a relatively few of the wells were in the county. The plant output was sold crude except for a small quantity, which was converted to potassium iodide. A salt company harvested crude salt from ponds by solar evaporation of sea water at Corona del Mar and sold the product to local consumers. Peat humus dug from a bog in the Huntington Beach area was dried and mixed with earth for use as topsoil.

Sand and gravel production rose about 200,000 tons above 1958. A decline in paving gravel output was offset by increases in building sand and gravel and specialty sands. The principal preparation plants were near Anaheim, Santa Ana, El Toro, and San Juan Capistrano. Blast sand was prepared at Huntington Beach, and foundry sand was produced from pits at Trabuco Canyon. Decomposed granite was obtained from a deposit near Costa Mesa and used as a road base. Contractors on various government projects quarried miscellaneus stone for road construction and flood-control projects. Kaolin and silica sand mined from the Schoeppe deposits near El Toro were sold for use in whiteware and as ganister, respectively. Miscellaneous clay from pits near Anaheim, Huntington Beach, and Tustin was used in manufacturing building brick, vitrified sewer pipe, and other heavy clay products. A plant at Anaheim exfoliated crude vermiculite, imported from Africa, for plaster aggregate.

Placer.—Sand and gravel production declined nearly 200,000 tons from 1958, due primarily to completion of designated road projects and of building and paving activity at Squaw Valley in preparation for the 1960 Winter Olympics. Fixed-plant operations near Auburn and Colfax and portable plants near Sheridan were principal sources of the 1959 output. Most of the crushed stone produced near Auburn and Gold Run was used for road base. Silica quartz quarried near Colfax was used in refractories and ground to make silica flour. Dimension and crushed granite was produced near Rocklin. The dimension granite was used as building and monumental stone; the crushed material for nursery, poultry, and roofing granules. Fire clays dug in the Lincoln area were used in manufacturing brick, sewer pipe, and other heavy clay products.

Except for a few ounces of lode gold and silver recovered from ore of a prospect near Foresthill and from cleanup operations at an unnamed property just west of the Auburn city limits, the county's gold and silver output was derived from placers. Relatively small quantities of placer gold and silver were produced at a dragline operation near Monte Vista, a nonfloating washing plant at Dutch Flat, a drift mine in the Iowa Hill area, and from reworked tailings near Foresthill. East of Loomis, a sand-and-gravel preparation plant recovered byproduct gold and silver. Various prospectors at widely scattered placer locations also recovered these metals, using small-scale hand equipment.

Plumas.—Manganese ore mined at the Plumas property near Crescent Mills was consigned to General Services Administration (GSA) under the carlot program. Ore from the Gold Stripe mine near Greenville yielded a few ounces of lode gold and silver. The ore was produced during development work, which reopened 450 feet of old tunnel. The Davis mine and the Comeback property in the same area and a prospect near the south end of Butt Valley Reservoir were sources of placer gold. Much of the placer gold and silver recovered in the county, however, was obtained from stream gravels at various locations by numerous prospectors.

The substantial drop in production of sand and gravel from 1958 was due primarily to lower requirements for paving material by the county road department. Road-construction activity of the California Division of Highways was also below that of 1958. A large portable sand and gravel plant near Belden was not in operation during 1959. Much of the year's output was from deposits in the Quincy area. A sand deposit near Vinton was a source of paving material used for road maintenance in the northeastern section of Sierra County. Stone for riprap was quarried near Tobin for railroad ballast.

Exploratory work at the Hyalumsil claims near Quincy yielded a few pounds of sericite schist, which was shipped to a prospective Fresno County consumer for experimental purposes.

Riverside.—The Eagle Mountain iron mine, the State's major iron mine and metal mine, was one of two active iron ore properties during the year. Mine ore production was 14 percent above the previous year. The output of direct shipping ore dropped 94 percent, but the quantity of concentrate produced at the nearby beneficiation plant rose 32 percent. Total shipments to the company furnaces at Fontana, San Bernardino County, increased 8 percent despite the steel strike, which closed the mine and plant from September 7 to October 26. Exploration and development work at the Eagle Mountain property included a total of more than 9,000 feet of diamond and rotary drilling. The Arlington and Langdon mines in the Little Maria Mountains near Blythe yielded manganese ore, some of which was upgraded before shipment to a Government stockpile. Gold was recovered from ore mined at the Hope prospect in Little Fargo Canyon on the southwest slope of the San Bernardino Mountains. Exploration for rare-earth minerals undertaken at the U-Thor claims in the Pinto Mountains resulted in some development ore that contained xenotime. The ore was not shipped.

Reported production and shipments of portland cement at the Crestmore plant increased 9 and 14 percent, respectively, above 1958. Although most of the limestone quarried in the county was consumed in manufacturing cement, significant tonnages were crushed for roofing granules or ground for special concrete mixes and for filler in asbestos products and fertilizers. Granite for riprap and decomposed granite for poultry grit and fill material were quarried near Riverside. The output of dimension stone for building construction and of crushed stone for roofing granules, near Corona and Whitewater, was below 1958. Sand and gravel production rose more than 500,000 tons above the previous year, owing to increased requirements for paving projects. The quantity of materials produced and prepared for building construction was only slightly below 1958. Over 240,000 tons of glass sand was produced near Corona in 1959. Fire clay and miscellaneous clay from pits in the Alberhill, Corona, and Elsinore areas were sold or used to manufacture refractory brick and heavy clay products. Clay used in cement was mined near Riverside.

Wollastonite collected in the Little Maria Mountains near Midland was shipped for ornamental use and industrial testing. In the same area, gypsum was mined, and consumed in the producers' wallboard plant at Midland. Reed-sedge peat dug near Banning was dried and shredded for use as a soil conditioner and as an ingredient in fertilizers. Crude-oil production from the county's single well in the Prado Dam area of Mahala field dropped 9 percent below 1958.

Sacramento.—California's first triple-zone gas completion was made in September in the River Island gasfield. Initial production from the well was at daily rates of 1.7, 2, and 2.2 million cubic feet. The same operator made a deeper pool discovery in the same area in October by deepening and recompleting a well of a former operator. There were several significant developments in the Walnut Grove-Thornton areas during 1959. Two new zones were discovered midway between River Island gasfield and the Walnut Grove area. In the latter area the operator completed a well that extended the productive limits of the area and made a deeper pool discovery with a northwest extension. Another operator also made a deeper pool discovery in the same area. Productive limits of the West Thornton area were extended one-half mile north, and a deeper pool discovery was made with a December gas completion.

Sand and gravel output declined nearly 500,000 tons from 1958, owing primarily to lesser requirements by Government agencies for paving projects. Demand for sand and gravel used in building construction was appreciably greater than in the previous year. Pits and plants near Sacramento, Del Paso, Perkins, and Fair Oaks were the principal sources for sand and gravel in 1959. Stone production was limited to those quantities quarried and crushed for Government road construction. Fire clay produced at the McDonell pit was sold for use in manufacturing brick and mortar. Deposits near Sacramento and Michigan Bar were worked for clays used in brick and tile. A plant in Sacramento exfoliated crude vermiculite mined in Montana.

A high percentage of the placer gold and silver output and all of the platinum recovered in the county came from a three-bucketline dredging operation on the American River. Five sand and gravel preparation plants recovered byproduct gold and silver.

San Benito.—Production and shipments of portland cement from a plant at San Juan Bautista were up from 1958. Four rotary kilns were operated and the product was shipped to consumers in California, Nevada, Oregon, and Washington. Limestone produced at the company's nearby quarry was consumed in manufacturing cement. Dolomite quarried near Hollister was used in making rock wool in Santa Clara County and in extracting magnesia from sea-water bittern in Alameda County. A substantial tonnage of granite was obtained from a quarry near Logan for riprap, road stone, concrete aggregate, and railroad ballast. Sand and gravel was produced and prepared at plants near Hollister by crews and contractors for State and county highway agencies. Bentonitic clays were mined near Idria for use in compounding well-drilling muds and at Tres Pinos for use as a filler in paint.

Only six small producing oil wells were completed in Vallecitos field. One hole, abandoned at 9,252 feet, was the deepest ever drilled in this field and the second deepest drilled in the county. An average of 37 wells produced during the year, 9 more than in 1958. Crude oil production rose 25 percent, and the wet-gas volume more than doubled that of the previous year.

There were 10 producing mercury mines in the county in addition to 1 marginal property that was leased and "high graded" by two prospectors. The State's leading mercury mine, in the Idria area, yielded more than 8,000 flasks. The San Carlos property, in the same area, was the only other mine in the county with a production of more than 100 flasks. Exploration and development work completed at the Idria property included long-hole and diamond drilling, shaft sinking, drifting, and cross cutting. About 100 feet of diamond drilling at the Turkey Hill claims near Paicines revealed cinnabar ore on the north side of the open-pit operation.

San Bernardino.—Four portland cement plants operated 27 kilns with a reported annual capacity of 19 million barrels. Two, at Colton and Oro Grande, used the dry process to manufacture cement; the other two at Victorville and Cushenberry, employed the wet method. The Oro Grande plant completed installation of new crushing, storage, and blending facilities and a digital computer to automatically control the blending and storage of raw materials for the grinding section.

About 95 percent of all the stone quarried in the county was limestone. Nearly all was consumed in manufacturing cement. Comparatively small tonnages were used for metallurgical flux, riprap, roofing granules, whiting, and various other purposes. Granite for riprap and decomposed granite for road base were quarried on several Government construction projects. Marble was obtained from a quarry near Victorville for terrazzo, and silica (quartz) was quarried near Oro Grande for use in making cement and rock wool and as a foundry sand and filler. Stone quarries in the Barstow area supplied material for roofing granules. More than 6 million tons of sand and gravel was produced in 1959, about 61 percent for use in building construction and the remainder for paving and fill. Pits and plants near Colton, San Bernardino, and Redlands were the principal locations for production. Lime plants at Colton and Trona operated rotary kilns and continuous hydrators to produce quick and hydrated lime for construction, agricultural, chemical, and other industrial uses. Ball clay produced near Ivanpah was consumed in whiteware and floor and wall tile. Near Daggett, Vidal, and Yermo, bentonite was mined for refractories, filter aids, and drilling mud. Miscellaneous clay used in manufacturing brick and tile was mined near Chino and Highgrove. The Chino area also was the source of shale expanded for lightweight aggregate. Clay from pits near Lucerne was used in manufacturing cement.

Brines from Searles Lake were processed for the recovery of various compounds in two chemical plants at opposite ends of the lake. At Trona, sodium borates, boric acid, potassium chloride and sulfate, soda ash, salt cake, elemental bromine, and crude dilithium-sodium phosphate were extracted. The West End plant recovered sodium borate, soda ash, salt cake, and Glauber's salt. Chemical plants in Los Angeles County purchased most of the liquid bromine for the preparation of various bromine compounds. Much of the potassium salts output was consumed in fertilizer plants. The crude lithium phosphate was converted to lithium carbonate and shipped for out-of-State consumption. Bristol Lake brines supplied California's entire calcium chloride output, which was recovered as a liquid at two plants. A third plant purchased liquid calcium chloride, which was refined in both liquid and flake form. The brines of Searles, Bristol, and Danby dry lakes were sources of crude salt recovered by solar evaporation. One producer used a dragline to mine a halite bed near Amboy, most of which was sold for making chlorine. The output was used in a water-softening plant.

Talc deposits in the county supplied more than one-third of State output in 1959. The crude mineral was shipped to grinders in the Los Angeles area. Five producers mined talc at 13 different properties, yet most of the crude mineral was obtained from deposits in the Tecopa and Silver Lake-Yucca Grove areas. Some development work, consisting principally of long-hole drilling, drifts, and crosscuts, was done at the Yucca Grove deposit in the Yucca Grove area. The Victorite pyrophyllite property, northeast of Victorville, was idle during the year, but shipments were made to grinders from stocks. A substantial tonnage of volcanic cinder was produced near Ludlow for railroad ballast. Volcanic ash was mined and screened near Hinkley and shipped to Palm Springs, Riverside County, for use as a soil conditioner. Crude barite mined from the Leviathan deposit near Barstow was shipped to the producer's grinding plant at Compton, Los Angeles County. Feldspar from the Beck mine near Four Corners was custom-ground in Los Angeles and used by the producer in pottery and refractories. A relatively small tonnage of Acid-grade fluorspar, produced from crude ore mined in the Clark Mountain area, was shipped to an Ohio dealer.

An average of three fewer producing wells in the Chino-Soquel and Mahala fields, compared with 1958, yielded 9 percent less crude oil but nearly 90 percent more wet gas.

The Iron Age property, a few miles southeast of Danby Lake, was the county's only active iron mine in 1959. Some ore from this mine was sold to cement plants; the remainder was upgraded by magnetic separation and shipped to iron and steel furnaces. The integrated steel plant at Fontana was the State's major steel plant and the only pig-iron producer. Manganese ores produced at the Logan mine in the Cady Mountains and at the Owl Hole and Ruby J. properties in the Owl's Head Mountains were shipped to a Government stockpile. Rare-earth concentrate, largely cerium oxide, was recovered from a barite-fluocarbonate ore mined at Mountain Pass and shipped to eastern plants. Most of the county's gold and silver output was recovered in treating material from the Kelly-mine ore dump, near Johannesburg. Copper ore from the Allured mine in the Ivanpah Mountains was the source of recoverable silver and copper. Silver, lead, and zinc were recovered from lead ore mined at the Mourange prospect south of Lucerne Valley; and a small tonnage of development ore mined at the old Silver Bow property, near the ghost town of Calico, yielded silver and lead.

San Diego.—A record output of 7.2 million tons of sand and gravel and 1.4 million tons of stone was reported. Building construction required nearly 3.9 million tons of the sand and gravel, and road construction and paving projects consumed much of the remainder. The increases occurred largely at pits operated in the San Diego metropolitan area. A deposit near Oceanside was a source of silica sand used for glass, molding, and filtration. The increased output of stone was due chiefly to more than 900,000 tons of decomposed granite produced for road base and fill. Dimension granite was quarried near Vista, Escondido, and El Cajon for use as surface plates and as building and monumental stone. Quartzite was quarried near La Cresta for building stone, flagging, and rubble. A substantial quantity of stone was quarried for the U.S. Army Corps of Engineers. Miscellaneous clay mined near San Diego was used principally in manufacturing building brick.

A Chula Vista plant recovered crude salt from sea water by solar evaporation. The entire plant output was sold locally to water-softening companies and food processors, and the saltworks bitterns were pumped to a nearby chemical plant for extraction of magnesium chloride. Three pyrophyllite properties were active during 1959, two in the San Dieguito area and one near Escondido. Shipments to grinders and consumers exceeded production, and yearend stocks were reduced by half. Grinders at Chula Vista, Escondido, and Los Angeles processed the crude mineral for a variety of uses. The Chula Vista plant also expanded crude perlite mined outside the county. A few tons of celestite was mined from the Fish Creek Mountains deposit and converted to various strontium compounds by the producer in a Los Angeles chemical plant. Gold ore mined from the Eagle Nest group of claims near Pine Valley yielded small quantities of gold and silver.

San Francisco.—Red rock was quarried and crushed at Candlestick Point principally for completion of the parking area of the new Candlestick baseball stadium and as base material for highway construction. Sand dredged from the bay bordering the City and County of

San Francisco and from the ocean-beach dune deposits, was used as fill material.

Crude and partially processed borates produced in Kern County were purchased by a San Francisco chemical plant and converted to various boron and sodium compounds. Another plant in the city ground soapstone from an El Dorado County mine, and talc from mines in Inyo and Shasta Counties.

San Joaquin.—Sand and gravel operations near Tracy, Clements, and along the Stanislaus River supplied most of the aggregate used for building construction and paving projects. The requirements for construction and maintenance of county roads were greater than in 1958. A small tonnage of stone was quarried and crushed for use as base material and railroad ballast. Clays mined from deposits near Tracy and Stockton were consumed in manufacturing brick, tile, and vitrified sewer pipe.

The River Island gasfield was extended into San Joaquin County, and initial production effected by a well completion in July. The southwest Vernalis area was discovered with a gas-well completion in August. This discovery was significant in that the operator controlled considerable acreage in the new area, which is about 3 miles southwest of the nearest producing well in Vernalis gasfield. Despite the extension and discovery, natural-gas output dropped nearly 4 percent from 1958.

A sand and gravel preparation plant near Clements recovered byproduct gold from stream gravels.

San Luis Obispo.—Crude-oil production from five fields—Arroyo Grande, Guadalupe, Morales Canyon, Russell Ranch, and Taylor Canyon—was 18 percent higher despite the fact that an average of 11 fewer wells were active, compared with 1958. However, the volume of wet gas produced and processed declined nearly 10 percent, while the output of natural-gas liquids from the county's only natural-gasoline plant at Russell Ranch was 8 percent lower. Two dry holes were drilled in the Soda Lake area, one reaching basement at 3,422 feet in April and the other at 7,143 feet in November. Two oil wells were completed in Arroyo Grande field during the year, one each in the Oak Park and Tiber areas. Also in the Oak Park area, one hole remained incompleted after 1,193 feet and another was idle after 2,570 feet. The driller on the site of the latter had filed intention to continue to 4,000 feet.

Sand and gravel production increased nearly 200,000 tons over 1958, due primarily to road-construction projects of the State and county highway agencies. The requirements for building construction were also greater in 1959. The principal preparation plants were operated near Paso Robles, Atascadero, Morro Bay, and Arroyo Grande. Molding and engine sands were produced near Oceano. Limestone was quarried near Adelaida for sugar refining, rubble, and roadstone. Granite, sandstone, and miscellaneous stone quarries yielded appreciable tonnages used principally for highway construction and flood-control projects. Gypsite was mined from a deposit near Simmler for agriculture, and miscellaneous clay dug near San Luis Obispo was consumed in manufacturing building brick.

Three mercury mines were productive in 1959. Most of the mercury output was furnaced from ores of the Buena Vista open-pit mine, the State's third largest producer. The Barneburg deposit near Laguna yielded manganese ore sold to GSA under the carlot program.

San Mateo.—A cement plant at Redwood City used oystershell and clay dredged from San Francisco Bay for raw materials and operated four rotary kilns to produce portland cement by the wet process. Production and shipments were above 1958 figures, and the output was consigned to consumers in California, Nevada, and Oregon, or shipped for export. The company barged bulk cement to its Yolo County distribution facility to supply customers in central and northern California. Some of the dredged oystershell was prepared for poultry grit and as filler in animal feed. Sandstone, basalt, decomposed granite, and limestone were obtained from quarries near Brisbane, Woodside, Pescadero, Rockaway Beach, and Belmont and used in building and paving. The quantities produced were equal to or slightly greater than the tonnages reported in 1958. Minor quantities of sand from beach dunes and sand and gravel from pits in the county were used as fill material. One company maintained a stockpile of crude gypsum, imported from Mexico, at the Port of Redwood City. All the crude mineral was either sold or used as a cement retarder.

At Redwood City a major salt company, with operations extending into Alameda and Santa Clara Counties, recovered a large tonnage of crude salt from sea water by solar evaporation. About 70 percent of the production was exported and the remainder shipped out of State. A chemical plant in South San Francisco purchased a calcined limestone-dolomite mixture used in its process for recovering magnesium hydroxide from sea water.

The South area of La Honda field, nearly 2 miles southeast of the Main area, was discovered when a well completed pumping in July. By yearend the operator had completed 5 additional wells in the new area, making a total of 12 active wells for the field in December. The single well in the Oil Creek area, completed in 1958, was active throughout the year. Despite these 1959 completions, volume outputs of oil and gas were below 1958 figures.

Santa Barbara.—Most of the exploratory drilling in the State's District No. 3 during the year was in Santa Barbara County and resulted in an offshore oil discovery of possible major importance. Casing was cemented in the hole and perforated at selected levels. It was reported that a contract had been executed for the construction of a permanent drilling platform at this location. Another interesting well was drilled offshore from Gaviota to a depth of 8,561 feet. An unconfirmed report indicated a large quantity of gas and some condensate blew in during testing operations. Favorable showings were reported to have been encountered offshore from Point Conception, approximately 11 miles west of Gaviota. The drilling program at the permanent platform in the Summerland offshore area was accelerated during the year. Of nine wells started during the year, five were completed and placed on production. In August the operator began drilling of two wells simultaneously from the same derrick.

A new platform was planned about 2 miles west of the existing platform, in 106 feet of water. The new platform will have two movable derricks constructed on tracks to permit drilling the two wells simultaneously. Completion of the project was expected by July 1960. Although crude-oil and natural-gas output declined, the volume of dry gas from Glenn Annie gasfield (discovered in 1958) was 90 percent above 1958. Two refineries operated near Santa Maria, one as a skimmer only. The other operated as a skimmer and asphalt plant with adjacent thermal-cracking facilities of which 250 barrels daily capacity was retired during 1959. Natural-gasoline plants near Cuyama, Orcutt, Goleta, and Santa Maria had a combined natural-gas liquids output 5 percent below 1958.

More than one-third of the world's diatomite output came from open-pit operations in the Lompoc area. Adjacent processing plants prepared the crude material, principally for use in filter aids, as filler in various products, and in insulation. Oil-saturated diatomaceous earth mined near Santa Maria was calcined and ground by the producer and sold for lightweight aggregate and manufacturing pozzolan cement. Sand and gravel production, principally from pits near Sisquoc, Santa Maria, Santa Barbara, and Solvang, increased. A substantial tonnage was produced for military projects in the Sisquoc area. Sandstone was quarried near San Marcos Pass for building stone and near Capistrano for riprap. Quarries in the Lompoc area supplied limestone and miscellaneous stone as dimension building stone, rubble, flagging, and road base. Clay mined in the San Marcos Pass area was used in manufacturing building brick. A gypsite deposit south of Ventucopa was mined to produce material for agriculture.

Activity at mercury mines was limited to the Gibraltar group near the reservoir north of Santa Barbara, which yielded ore furnaced to produce the metal.

Santa Clara.—At Permanente, the State's largest portland-cement plant produced most types of cement, including masonry cement, for which it was the sole producer. Shipments were made to consumers in California, Nevada, Oregon, Washington, Alaska, and Hawaii. The company quarried limestone nearby for manufacturing cement, and for building and paving. Crushed stone was produced at quarries in the San Jose, Milpitas, Los Altos, and Los Gatos areas for riprap, concrete aggregate, and roadstone. Total stone output was higher than 1958 including a greater tonnage of oystershell dredged from San Francisco Bay and used for poultry grit and in animal feed. The San Jose area required greater tonnages of sand and gravel for building and paving projects, compared with 1958. The 1959 output, which included operations in the Cupertino, Los Gatos, Morgan Hill, and Gilroy areas, increased more than 1 million tons over the previous year. Clay mined from deposits near San Jose was used in manufacturing, building brick and flue linings. Magnesite from the Western quarry near Livermore was used by an Alameda County plant to make hydrous magnesium sulfate.

The Gaudalupe and New Almaden mines were the only producing mercury properties. At the New Almaden, 20 lessees worked dump ore all or part of the year. One produced more than 600 flasks of mercury metal.

Two oil wells were active in the old Moody Gulch field during January, November, and December. The volume of crude oil obtained was about 50 barrels less than in 1958.

Santa Cruz.—In 1955, about 6 miles west of Santa Cruz, an experimental project was begun in an attempt to adopt the Swedish Ljingstrom method for recovering hydrocarbons from bituminous sandstone. In Sweden electricity was the source of heat in situ to recover hydrocarbons from oil shale; at Santa Cruz gas (propane) was used as fuel for the underground heaters. A total of 228 burner-producer wells, 78 temperature-observation wells, 31 gas wells, and 32 miscellaneous test, observation, and water-production wells were drilled. The heating phase of the test, that of heating the test area from a depth of 15 to 45 feet, was completed in January 1959. Products were collected during the test as vapors and condensed through a water-cooled condenser. Total production for the test was 2,665 barrels of oil, 4,520 thousand cubic feet of gas and 9,232 barrels of water. Average gravity of the oil recovered was 27 degrees.

Production and shipments of portland cement from the Davenport nine-kiln dry-process plant were higher than in 1958. The company quarried limestone and shale for raw materials from sites near the plant. Shale also was quarried near San Juan Bautista for use in making cement. Shipments from the Davenport plant were principally to northern California customers and consisted of general-use and moderate-heat cements. A relatively small tonnage of flue dust accumulated at the plant was sold for agriculture because of its potash content. A limestone quarry near Santa Cruz was a source of dimension stone for rubble and prepared poultry grit. Quarries near Felton and Soquel supplied crushed stone for aggregate and road base. Pits in the Santa Cruz and Felton areas yielded nearly 800,000 tons of sand and gravel used principally as concrete aggregate.

Shasta.—Plans were announced for building a $14 million cement plant at Redding with a 1.5-million-barrel annual capacity, to be completed about mid-1961. High-grade limestone and shale are available nearby to supply the raw materials needed.

Sand and gravel operations near Redding were the principal sources of aggregate used for highway construction and linings in tunnel projects. Total output in the county was nearly double the 1958 figure. Stone was quarried by contractors of county and Federal agencies for riprap and roadstone. Volcanic cinder produced from deposits near Glenburn and Fall River Mills was used in road construction.

Pyrite produced at the Iron Mountain (Hornet) open-pit mine was roasted to make sulfuric acid at Contra Costa County chemical plants and a Nevada copper-leaching plant. The resulting pyrite cinder from the California acid plants was sold for use as an additive in special cements. Copper precipitates recovered at the Iron Mountain operation accounted for all the copper credited to the county in 1959. Some silver and lead also were recovered in processing the precipitates. The company completed more than 1,500 feet of diamond drilling as a part of its exploration and development program. Gold ores from mines in the Iron Mountain, Redding, French Gulch, and Centerville areas were the source of all the lode gold and most of the lode silver credited to the county. Much of the placer gold and silver was obtained by a dragline operation on the Davis property near Redding. Other smaller recoveries were made by miners and prospectors who used small-scale hand methods at various locations in the county.

A relatively small tonnage of tremolite asbestos was mined and shipped from the Sylvester property near Sims. Some steatite-grade talc was obtained from the Ganim mine, a gold property near Schilling. The crude mineral was ground in the San Francisco Bay area for use in ceramics.

Sierra.—Lode-gold mines in the Downieville and Allegheny areas supplied most of the county's mineral production. Much of the gold and silver output came from ores of the Brush Creek mine a few miles southwest of Downieville and the Original 16-to-1 mine at Allegheny. A relatively small quantity of zinc also was recovered from ores of the former mine. Gold, recovered from the Espy placer property near Pike from 1955 through 1959, was sold in 1959. Ancient riverbeds were worked in the Indian Hill area and yielded placer gold and silver. Remaining recoveries were made by prospectors who worked stream gravels along the Yuba River using small-scale hand equipment.

Sand and gravel output consisted mostly of fill material obtained from variously located pits by crews and contractors of the county and State road agencies. Producers in adjoining counties supplied concrete aggregate used for building construction. Quartz was quarried in the Crystal Peak area and sold to an Oregon silicon producer.

Siskiyou.—Sand and gravel production increased substantially because of greater demand for its use in road construction. Klamath River, Yreka, and Mt. Shasta were principal areas where sand and gravel deposits were worked during the year. Most of the more than 200,000 tons of pumice and volcanic cinder produced in the county was mined from a deposit near Kegg and used for railroad ballast. Pumice from the Tule Lake area was consumed as concrete aggregate, and cinder produced at various other locations, principally near the Modoc County line, was used in building roads and trails and as fill material.

Virtually all the gold and silver output was recovered by cyanidation from ore of the Siskon mine near Happy Camp. Only two other lode properties reported any activity. Except for the placer gold and silver reported by itinerant miners and prospectors, production originated at one dragline dredge near Seiad Valley, and two hydraulic operations in the Cecilville area.

Solano.—A well completion in August made a shallower pool discovery and extended the productive limits of Suisun Bay gasfield nearly 2 miles to the northwest. Production was from the same zone from which gas blew out in a nearby well. This gasblow was stopped July 5 by pumping in heavy fluid and cement. A new pool discovery was made at the south end of Winters field by a well completion in September. Dry-gas production came from Rio Vista, Winters, Suisun Bay, Cache Slough, Main Prairie, Millar, Liberty Cut, and

Kirby Hill fields. Total output of natural gas was slightly above 1958, although an average of 15 fewer wells were active in 1959.

Shale was quarried near Vallejo and hauled to a Napa County plant, where it was expanded for use in lightweight aggregate for concrete block and in prestressed and precast concrete products. Sand and gravel production was limited primarily to paving gravel used in State and county road construction. Crushed stone from basalt and miscellaneous stone quarries near Thomason, Vallejo, and Benicia was prepared for roadstone and fill.

Sonoma.—Production of sand and gravel, principally near Healdsburg and the Cloverdale and Santa Rosa areas, totaled over 1.5 million tons. Basalt and miscellaneous stone quarries near Petaluma, Forestville, Sonoma, Occidental, and Cotati were sources for riprap, roadstone, and fill material. Dimension building stone, flagging, and rubble were prepared at stone quarries near Glen Ellen. Shale was quarried near Santa Rosa for use as fill.

Four mercury mines were worked during the year. The yield in mercury from the Mt. Jackson property near Guerneville was second highest in the State. Ores from the Buckman group and two prospects east of Cloverdale yielded a few flasks of mercury. Exploration and development work at the Buckman property in 1959 included several hundred feet of drifts and crosscuts, and production of about 20,000 tons of development ore.

The productive limits of Petaluma field were extended about one-half mile northwest with a gas-well completion in October.

Stanislaus.—Larger quantities of sand and gravel were produced for use in paving projects than in 1958. Principal producers operated preparation plants along the San Joaquin, Tuolumne, and Stanislaus Rivers near Newman, Modesto, Waterford, Oakdale, and Knights Ferry. Dimension sandstone was quarried near La Grange for use as rubble. Fire clay and stoneware clay were mined in the Oakdale, Knights Ferry, and La Grange areas and used in manufacturing heavy clay products.

The Buckeye manganese mine in the Mt. Oso area was worked by two operators, both of whom shipped manganese ore to a Government stockpile. One operator also mined low-grade manganese ore consigned to an Arizona concentrator. Cinnabar ore from the Adobe mine near Patterson was retorted to yield a small quantity of mercury.

Sutter.—Natural-gas output from the county's only field, Marysville Butte, was 15 percent lower than in 1958, yet the average number of producing wells was the same.

Paving projects consumed virtually all sand and gravel produced in the county. The principal sources bordered the Feather River near Live Oak and the Bear River near Wheatland. Stone was quarried and used as riprap by a contractor for the county road agency. Miscellaneous clay was mined near Nicolaus and used in manufacturing vitrified sewer pipe and other heavy clay products.

Tehama.—Building construction at Red Bluff and paving projects of the State and county highway agencies required over 250,000 tons of sand and gravel. Preparation plants were located along the Sacramento River near Red Bluff and Redding. A small tonnage of building stone was quarried by maintenance crews of the Lassen Volcanic National Park.

A deeper pool was discovered after a well completion in September, which extended the South Corning gasfield. Production was from Kione sands and the first Cretaceous production found north of Willows-Beehive Bend gasfield, which is 20 miles south. Natural-gas output from the Corning and South Corning gasfields rose 26 percent above 1958 despite an average of one less producing well in 1959.

The Manganese King mine near Tedoc Mountain was the source of manganese ore consigned to GSA and of low-grade manganese ore sold to an Arizona mill.

Trinity.—The Trinity Dam project of the Federal Bureau of Reclamation required a substantial part of the sand and gravel and crushed stone produced during 1959. Sand and gravel from pits near Weaverville and Lewiston were used principally for concrete aggregate and base material. Virtually all crushed and broken stone output was used for riprap.

The Altoona mine in the Castle Creek area was the county's only producing mercury property in 1959. Exploration and development work at this mine during the year consisted of drifts, raises, and crosscuts. A hydraulic operation at Big Bar and a suction dredge on Crow Creek near the Shasta-Siskiyou county line yielded gold and silver, as did numerous small-scale placer operations at various locations in the county.

Tulare.—An average of 33 dry-gas wells and 21 oil wells were active in 1959, compared with 31 and 19 in the previous year. Natural-gas output rose 11 percent, and crude-oil production dropped nearly 15 percent. Production came from Trico, the county's only gasfield (which extends into Kern and Kings Counties) and Deer Park, the county's only oilfield.

Greater tonnages of building sand and gravel were produced than in 1958, offsetting a lower demand for road-surfacing material. The principal producers operated preparation plants in the Porterville and Lemon Cove areas. Virtually the entire output of crushed and broken stone was by contractors and crews of Government agencies who used the materials on road projects. Miscellaneous clay dug near Exeter was consumed by a Fresno County brick manufacturer. Crude barite, mined from adjacent properties in Nine Mile Canyon, was upgraded in a jigging plant at Linnie Station, Inyo County, before shipment to the producer's grinding plant in Kern County.

Tuolumne.—Crushed-stone production increased to supply construction and maintenance projects along the Hetch Hetchy aqueduct and requirements of the State and county highway agencies for road maintenance. Limestone was quarried at the Sonora and Columbia quarries and prepared for glass, lime, mineral food, and other uses. Quick and hydrated lime was produced at a Sonora plant, which operated one rotary and four shaft kilns and a continuous hydrator. Virtually all plant output was marketed for industrial chemical uses; construction and agriculture consumed the remainder. The Sonora area was also the source of marble used for terrazzo. Dimension, building stone, riprap, and roadstone were quarried near Twain

Harte. Sand and gravel was produced from pits near Sonora and used principally for road surfacing.

Gold ore from the Ryan mine at Mi Wuk Village yielded recoverable gold and silver. A placer property on Moccasin Creek southwest of Jacksonville was worked in 1958, and the gold recovered was sold in 1959.

Ventura.—Drilling activity for oil and gas decreased slightly during 1959; 165 notices to drill wells were filed, compared with 196 in 1958. Of the total, 42 were classified as exploratory, 5 as waterflood for secondary recovery, and 118 as development. Abandonment operations increased; 81 proposals for such work were submitted. Only nine of these were former producing wells. Rincon field was first in drilling activity, followed by Ventura, South Mountain, and Oxnard fields. New pool discoveries were made in Ojai, Oxnard, and South Mountain fields, and in the Piru Creek area. Extensions of known pools were made in Filmore, Oxnard, South Mountain, Ventura, and Rincon fields. The construction of a 10-inch cement-lined waste-water-disposal pipeline from the Saticoy oilfield to the city of Oxnard industrial waste plant, a distance of about 12 miles, was completed in November. Maximum capacity of the pipeline was reported to exceed 40,000 barrels per day. By the end of 1959, only oilfield brine from the Saticoy field had been shipped through the line. At some future time the line might be extended to the east to provide waste-disposal facilities to other oilfields and possibly to nearby municipalities.

Production of crude oil and natural gas (both wet and dry) declined 6 and 4 percent, respectively, from the previous year. Despite the decrease, volume output from the county's 10 natural-gasoline plants (including 1 new in 1959) was 4 percent higher. A skimming plant was operated at Ventura, and two plants were active at Oxnard—one asphalt only, the other skimming and asphalt. The daily throughput capacity at the latter plant was increased 500 barrels in 1959.

Sand and gravel was produced from pits in the Ventura, Santa Paula, Saticoy, and Moorpark areas for use as concrete aggregate and roadstone. The output of molding sand from a deposit near Ventura was appreciably higher than in 1958. Gravel for railroad ballast was prepared at a plant near Santa Paula. Breakwater and embankment projects of the U.S. Army Corps of Engineers and construction in the Point Mugu area accounted for much of the increased output of quarried stone. Limestone was obtained from a quarry near Santa Suzana and prepared for use as poultry grit and as filler in animal feed and fertilizer. Dimension sandstone was quarried near Ojai and dressed for use in building construction. Clay and shale mined from deposits near Ventura and Frazier Park were expanded and used for lightweight aggregate. A cement company at Monolith, Kern County, quarried gypsum in Quatal Canyon for its own use.

Yolo.—A substantial part of the total sand and gravel produced in 1959 was used for paving projects in Yolo, Solano, and Sacramento Counties. Demand for sand and gravel for building construction also gained appreciably. The principal producers operated fixed plants in the Madison and Woodland areas.

Although natural dry-gas production was 4 percent below 1958, volume output from Winters (that portion credited to Yolo County) and Sycamore Slough gasfields rose 5 and 11 percent, repectively; that from Dunrigan field dropped nearly 29 percent. The average number of producing wells was the same as in 1958.

Yuba.—The State's major placer-gold operation was in the Yuba Basin near Hammonton, where four bucket-line dredges worked stream gravels. A high percentage of the placer gold, silver, and platinum credited to the county and State were recovered in this operation. An electrostatic separation unit was operated in the same area on tailings from the dredges and yielded appreciable quantities of gold and silver. A sand preparation plant east of Marysville recovered byproduct gold and silver, and a suction dredge at Rock Island Bar worked old tailings for a few ounces of gold. All lode gold, silver, copper, and zinc produced in the county during the year came from the gold ores of the Dannebroge (Browns Valley group of claims) mine at Browns Valley.

Sand and gravel production dropped to almost half the 1958 output, due chiefly to the lesser requirements for flood control by the U.S. Army Crops of Engineers. Commercial plants in the Marysville area supplied sand and gravel for building and paving in the immediate area as well as some requirements in Sutter County. Miscellaneous clay mined near Wheatland was used in manufacturing sewer pipe and other heavy clay products.

The Mineral Industry of Colorado

By Alfred L. Ransome,[1] F. J. Kelly,[2] William H. Kerns,[2] and D. H. Mullen [2]

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ALTHOUGH output of Colorado's major mineral product—petroleum—continued to decline, the upward climb of overall mineral value was resumed in 1959 after dropping in 1958. Minerals produced in Colorado were valued at $313.4 million, 2 percent above the $306.6 million value in 1958 and only 7 percent below the 1957 record of $338.5 million. Molybdenum and uranium continued as the principal metals, and cement and sand and gravel again were the principal nonmetals.

Mineral fuels represented 55 percent of the value of mineral production—4 percent less than in 1958. Petroleum output, which accounted for 43 percent of the total value, decreased 5 percent in quantity and 8 percent in value, primarily because of a lower output from the Rangely field and a slightly lower per-barrel price. In contrast, coal production rose 11 percent over 1958, largely owing to greater demand for power generation, and the $21-million value represented 7 percent of the value of the State's mineral production.

Metals accounted for 31 percent of the value of all minerals produced—4 percent more than in 1958—and as a group advanced from $81.8 million in 1958 to $97.2 million in 1959. Increased demand for molybdenum and a planned program of capacity production resulted in a marked gain in output of this important Colorado metal. Uranium continued second to molybdenum in importance in the State's mineral economy. The value of output, although virtually unchanged, represented 7 percent of the value of Colorado's mineral production and 15 percent of the value of domestic output of uranium ore. Although the price of lead continued to decline, copper and zinc prices reversed their downward trend and showed substantial gains in 1959. The quantities of copper, lead, and zinc produced, as well as those of gold and silver, decreased, but the total value of these five metals was $16.3 million—only 8 percent less than in 1958, compared with a 31-percent drop from 1957 to 1958.

Although moderate, the most significant advances (both in quantity and value of production) among the 14 nonmetals produced in Colorado continued to be made by the commodities most important to the construction industry—cement and sand and gravel. Nonmetal production as a group was just slightly below 1958 in value and again accounted for 14 percent of the value of all minerals produced.

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TABLE 1.—Mineral production in Colorado[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate[2] .... gross weight	134	$58	124	$58
Carbon dioxide .... thousand cubic feet	(3)	(3)	175,223	(3)
Clays .... thousand short tons	448	1,111	417	1,160
Coal .... do	2,974	19,305	3,294	21,034
Columbium-tantalum concentrate .... pounds	2,280	7	------	------
Copper (recoverable content of ores, etc.)	4,193	2,206	2,940	1,805
Feldspar .... long tons	34,648	237	(3)	(3)
Gem stones	(4)	38	(4)	43
Gold (recoverable content of ores, etc.) .... troy ounces	79,539	2,784	61,097	2,138
Gypsum .... thousand short tons	103	341	106	385
Iron ore (usable) .... thousand long tons, gross weight	(3)	(3)	11	78
Lead (recoverable content of ores, etc.)	14,112	3,302	12,907	2,969
Manganese ore and concentrate (35 percent or more Mn) .... gross weight	210	17	1,218	102
Mica: Scrap	387	6	68	1
Natural gas .... million cubic feet	82,464	8,659	[5] 98,600	[5] 10,600
Natural-gas liquids:				
Natural gasoline .... thousand gallons	49,505	3,410	47,424	2,811
LP-gases .... do	68,027	3,343	77,637	3,671
Peat	7,143	41	6,674	35
Petroleum (crude) .... thousand 42-gallon barrels	[6] 48,736	[6] 145,721	[5] 46,150	[5] 133,835
Pumice .... thousand short tons	34	65	40	66
Pyrites .... thousand long tons	67	359	(3)	(3)
Rare-earth metals and thorium concentrates	650	35	9	1
Sand and gravel .... thousand short tons	20,626	17,842	20,897	18,817
Silver (recoverable content of ores, etc.) thousand troy ounces	2,056	1,860	1,341	1,213
Stone .... thousand short tons	2,930	4,943	2,824	5,537
Tin (content of concentrate) .... long tons	------	------	50	60
Uranium ore	939,706	22,486	1,044,089	[7] 22,546
Vanadium .... thousand pounds	4,791	(3)	5,897	(3)
Zinc (recoverable content of ores, etc.)	37,132	7,575	35,388	8,139
Value of items that cannot be disclosed: Cement, fluorspar, lime, molybdenum, perlite, salt, tungsten concentrate, and values indicated by footnote 3	------	62,855	------	79,229
Total Colorado[8]	------	[6] 306,561	------	313,438

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes low-grade beryl shipments totaling 42 tons (2.84 percent BeO) valued at $5,000 (1958) and 97 tons (4.45 percent BeO) valued at $8,622 (1959).

[3] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

[4] Weight not recorded.

[5] Preliminary figure.

[6] Revised figure.

[7] Final figure, supersedes figure given in commodity chapter.

[8] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

Of interest in the metals industry was the expansion of the Cotter Corp. uranium mill at Canon City from a capacity of 100 to 200 tons per day.

Experimental work on retorting oil shale was continued by the Denver Research Institute, but the Union Oil Co. began dismantling its pilot plant at Grand Valley. The plant had suspended operations in July 1958.

Several events were significant in the nonmetals industry in 1959. Great Western Aggregates, Inc., a subsidiary of Ideal Cement Co., completed plans to erect a 300,000-cubic-yard-per-year shale-processing plant near Denver. Ozark-Mahoning Co. shut down its Cowdrey, Jackson County, fluorspar operation January 31. International Minerals & Chemical Corp., the only custom grinder of feldspar in Colorado, closed its grinding plant at Denver early in 1959.

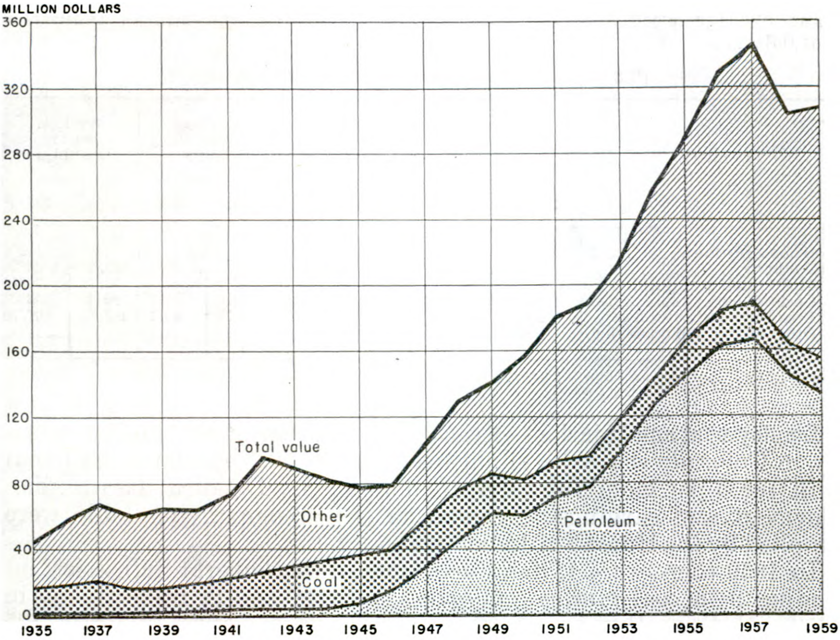

FIGURE 1.—Value of petroleum and coal and total value of all minerals produced in Colorado, 1935–59 (excludes uranium 1941–55).

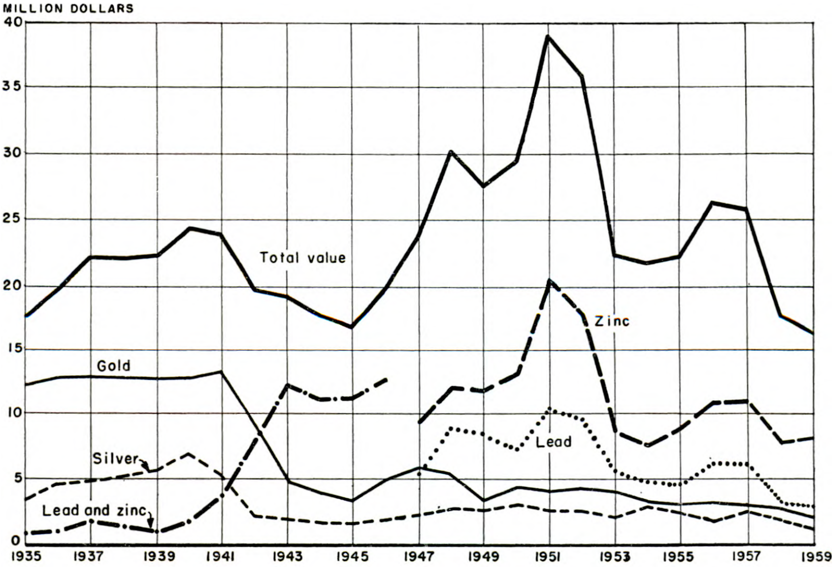

FIGURE 2.—Value of mine production of gold, silver, lead, and zinc and total value of these minerals (including copper) in Colorado, 1935–59.

TABLE 2.—Average employment, average hourly earnings, average weekly hours, and average weekly earnings in the nonagricultural and mining industries of Colorado

[U.S. Department of Labor, Bureau of Labor Statistics]

Industry	Average employment		Average hourly earnings		Average weekly hours		Average weekly earnings	
	1958 [1]	1959	1958	1959	1958	1959	1958	1959
Total nonagricultural	465,400	482,700	--------	--------	--------	--------	--------	--------
Total mining	15,300	15,400	$2.48	$2.57	39.2	39.8	$97.22	$102.29
Metal mining	5,700	5,800	2.30	2.37	41.2	40.7	94.76	96.46
Coal mining	2,100	2,100	3.00	3.25	29.8	31.7	89.40	103.03
Petroleum and natural gas	6,600	6,700	2.49	2.54	41.7	42.4	103.83	107.70
Other mining and quarrying	900	800	--------	--------	--------	--------	--------	--------

[1] Revised figures.

Employment and Injuries.—Average employment in the mining industry in Colorado showed a slight overall gain (0.7 percent), compared with the 5-percent decline recorded in 1958. Detailed data on employment and earnings presented in the accompanying table were supplied by the Bureau of Labor Statistics.

In 1959 there were 15 fatal accidents in the mineral industries, including 2 in coal mining, compared with 13 and 2, respectively, in 1958. Federal Bureau of Mines preliminary figures indicate 405 nonfatal injuries (including 392 temporary) in the mineral industry in 1959 compared with 611 (574 temporary) in 1958. As in 1958, most of the injuries were in metal mining.

Legislation and Government Programs.—Government participation in strategic minerals exploration dwindled, and only one Office of Minerals Exploration (OME) contract was executed for $84,500 compared with 10 Defense Minerals Exploration Administration (DMEA) contracts totaling $492,200 in 1958. The single contract in 1959 covered exploration for copper, lead, and zinc with 50-percent Government participation.

All manganese ore and concentrate produced in Colorado in 1959 was shipped under the Government carlot-purchase program administered by the General Services Administration (GSA). The program closed when the quota of purchases for the national stockpile was reached on August 5. Most of the high-grade beryllium concentrate mined in the State was shipped to the Government purchase depot at Custer, S. Dak. With the termination of the Government fluorspar purchase program at the end of 1958, all but one of the fluorspar mines in Colorado ceased operating.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of the mineral fuels—carbon dioxide, coal, natural gas, natural-gas liquids, peat, and petroleum—produced in Colorado was $172 million. This amount was a decline of $8 million below 1958 and represented 55 percent of the value of all minerals produced in the State. The decline was primarily in the value of petroleum and natural gasoline. Substantial gains were recorded in the value of liquid-petroleum gases, natural gas, and coal.

Asphalt and Related Bitumens.—The American Gilsonite Co. operated its processing plant near Fruita with increasingly satisfactory results. Continued expansion of the plant was planned, and extensive research had developed additional products. A diesel fuel oil was developed that is equal or superior to similar oils from crude petroleum, and extended use of the diesel product would further expand operations.

Carbon Dioxide.—Production of carbon dioxide from wells in Las Animas and Montezuma Counties increased 5 percent compared with 1958. The gas was converted into dry ice and liquid carbon dioxide at plants in Bent and Montezuma Counties.

Coal.—Coal production from 98 mines in 16 counties (108 mines in 1958) increased 11 percent over 1958. Gains were recorded in eight counties and declines in the remaining eight. Production was high during the first part of the year but was lower in some counties during the last half of the year because of the prolonged steel strike that idled some mines for several months. The increase was attributed to greater use of coal in thermal powerplants. The second 100,000-kw. unit of the Cherokee powerplant at Denver began operating in April, and the entire production of the Navajo strip mine in Montrose County was used at the powerplant at Nucla. Consumption of coal increased at the Cameo plant in Mesa County. Greater use of electric power in all industries was apparent. Installed capacity in generating plants at the end of the year totaled 829 megawatts, and only two small plants used oil or gas exclusively. Investigation into greater use of coal for various purposes, including coal and coal tar for road paving, was being made by private and State agencies.

TABLE 3.—Production of coal, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1958		1959	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Delta	49,503	$5.67	69,548	$5.18
El Paso	7,599	7.11	4,392	7.51
Fremont	250,634	3.76	280,113	3.57
Garfield	20,184	6.24	16,767	6.19
Gunnison	283,661	5.88	262,931	5.73
Huerfano	63,269	6.41	59,744	5.98
Jackson	31,133	2.32	119,759	2.18
La Plata	33,058	5.03	28,015	4.61
Las Animas	768,275	10.24	693,406	11.91
Mesa	84,388	5.57	88,677	5.95
Moffat	[2] 388,661	[2] 7.37	[3] 480,860	[3] 7.19
Montrose	1,991	7.49	([3])	([3])
Pitkin	([2])	([2])	([3])	([3])
Rio Blanco	12,653	7.20	10,840	6.14
Routt	399,169	3.89	397,279	3.75
Weld	580,011	4.70	781,811	4.45
Total	2,974,189	6.49	3,294,142	6.39

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[1] Value received or charged f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially).

[2] Production of Pitkin County combined with Moffat County to avoid disclosing individual company confidential data.

[3] Production of Montrose and Pitkin Counties combined with Moffat County to avoid disclosing individual company confidential data.

The Federal Bureau of Mines continued its long-range investigations of coal utilization at its Denver Coal Research Laboratory. Studies included fluidized low-temperature carbonization of bituminous coals and lignites, coking properties of selected western coals, carbonization assays, and investigations of low-temperature tars. A report[3] was published covering part of the investigations.

Natural Gas.—Natural gas, from wells in 15 counties, and residual gas, from natural-gasoline plants in 5 counties, marketed through pipelines to consumers, increased 22 percent in value compared with 1958. Exploratory drilling resulted in 23 new gasfields in 11 counties, with 4 each in La Plata and Rio Blanco Counties. Development drilling yielded 60 new producers. Most of the successful development wells were in La Plata (33), Morgan (6), and Rio Blanco (4) Counties.

Public Service Co. of Colorado began tests at the abandoned Leyden coal mine west of Denver to determine the feasibility of using the caverns created by the removal of coal for natural-gas storage. Initial work indicated the area was gastight, and four drill holes were completed into the mine for the introduction and recovery of the gas and to vent air and other gases as the natural gas was pumped into the mine. Gas injection was begun in September, and at yearend the installation of three compressors capable of pumping 15 million cubic feet of gas a day was nearing completion. It was estimated that 3 billion cubic feet of gas could be stored under a pressure of 300 pounds per square inch. The stored gas would be used during peak periods in the winter when demands on the pipelines from Oklahoma and Texas fields were greatest. Considerably more development work remained to be done before the project, estimated to cost $5.5 million, was completed.

Natural-Gas Liquids.—Natural gasoline, butane, and propane were recovered from plants in six counties. The quantity was 6 percent greater than in 1958; natural gasoline declined 4 percent, and butane and propane increased 14 percent. Of the 14 operating plants, 10 were absorption and 4 refrigeration. Residual gas was marketed through pipelines to consumers.

Peat.—Peat humus was mined in Boulder, Gilpin, and Teller Counties for use as an admixture in fertilizer and as a soil conditioner. Production was 7 percent below that of 1958.

Petroleum.—Production of petroleum from 317 fields in 19 counties was 5 percent less than in 1958. Gradual depletion of many of the older fields was not compensated by new discoveries. In only six counties—Fremont, Jackson, La Plata, Moffat, Montezuma, and Morgan—was the production in 1959 greater than in 1958. The progress of the waterflood and unit operation of the Rangely field in Rio Blanco County were of considerable interest. As of December 31, the cumulative injection of water into the Weber formation through 38 wells was 8.8 million barrels. Production from the field was 17.1 million barrels compared with 20.5 million barrels in 1958. Volume of output, however, was expected to increase, and it was estimated that at yearend 1,450 barrels of the 45,600-barrel-a-day production would result from the waterflood. Considerably more development remained before the waterflood operation would be stabilized.

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[3] Goodman, John B., and Detrick, R. Sherman, Thermal Refining of Low-Temperature Tar: Bureau of Mines Rept. of Investigations 5534, 1959, 43 pp.

TABLE 4.—Production of crude petroleum, by counties[1]

(Thousand barrels)

County	1958	1959 (preliminary)	Principal fields in 1959 in order of production
Adams	773	672	Badger Creek, Middlemist, Beacon.
Archuleta	117	113	Price Gramps.
Bent	1	1	McClave.
Boulder	3	2	Boulder.
Fremont	27	39	Florence-Canon City.
Jackson	925	934	McCallum, Battleship, South McCallum.
Jefferson	2	1	Soda Lake.
Kiowa	----------	2	Brandon.
La Plata	18	20	Red Mesa, Barker Dome.
Larimer	206	192	Fort Collins, Wellington.
Logan	5,696	5,187	Cliff, Northwest Graylin, Yenter, East Atwood.
Moffat	1,159	1,292	Danforth Hills, Iles, Powder Wash.
Montezuma	4	106	Flodine Park, Towaoc.
Morgan	7,241	8,556	Adena, Bijou, Zorichak.
Prowers	----------	1	Barrel Springs.
Rio Blanco	23,505	20,425	Rangely, Wilson Creek.
Routt	161	113	Tow Creek, Curtis.
Washington	6,793	6,726	Big Beaver, Little Beaver, Plum Bush Creek.
Weld	2,105	1,768	Pierce, Black Hollow, New Windsor.
Total	48,736	46,150	

[1] Distribution by county affected by use of Colorado Oil and Gas Conservation Commission data adjusted to Bureau of Mines total.

TABLE 5.—Wildcat- and development-well completions in 1959, by counties

[Oil and Gas Journal]

County	Crude	Gas	Dry	Total	Footage
WILDCAT					
Adams	5	1	17	23	133,900
Arapahoe	----	----	3	3	17,600
Archuleta	----	----	7	7	15,400
Baca	----	1	7	8	42,500
Bent	----	----	4	4	20,100
Boulder	----	----	2	2	7,000
Dolores	----	----	1	1	5,900
Elbert	----	----	6	6	33,600
El Paso	----	----	1	1	500
Fremont	----	----	1	1	200
Garfield	1	2	6	9	37,300
Grand	----	----	2	2	5,900
Huerfano	----	----	7	7	18,500
Jackson	1	----	4	5	19,600
Kiowa	1	----	1	2	10,500
Kit Carson	----	----	4	4	22,400
La Plata	2	4	4	10	60,900
Larimer	----	----	4	4	20,400
Las Animas	----	----	5	5	15,300
Logan	6	3	56	65	331,800
Mesa	----	2	8	10	33,500
Moffat	----	1	22	23	135,300
Montezuma	4	----	11	15	50,600
Montrose	----	----	1	1	15,000
Morgan	6	1	57	64	372,200
Ouray	----	----	3	3	5,700
Prowers	1	----	3	4	21,900
Pueblo	----	----	2	2	8,200
Rio Blanco	1	4	10	15	80,800
Routt	2	----	15	17	65,900
San Miguel	----	----	1	1	10,800
Washington	7	1	65	73	365,800
Weld	----	3	49	52	355,200
Yuma	----	----	7	7	38,600
Total wildcat	37	23	396	456	2,378,800
DEVELOPMENT					
Adams	3	----	15	18	111,000
Archuleta	1	----	----	1	1,300
Fremont	4	1	10	15	42,600
Garfield	----	2	2	4	18,800
Jackson	3	----	2	5	25,000
Kiowa	----	3	1	4	19,900
La Plata	1	33	2	36	214,900
Larimer	1	----	1	2	11,200
Logan	19	2	[1] 33	54	272,800
Mesa	----	2	1	3	13,200
Moffat	5	3	4	12	60,900
Montezuma	1	----	4	5	29,800
Morgan	[2] 35	6	32	73	436,400
Prowers	----	----	1	1	5,200
Rio Blanco	14	4	8	26	101,800
Routt	2	----	2	4	21,000
Sedgwick	----	1	----	1	3,500
Washington	[2] 34	3	[1] 38	75	371,400
Weld	2	----	12	14	95,600
Total development	[3] 125	60	[4] 168	353	1,856,300
Total, all drilling	[3] 162	83	[4] 564	809	4,235,100

[1] Includes 2 development service-well completions.
[2] Includes 1 development condensate-well completion.
[3] Includes 2 development condensate-well completions.
[4] Includes 4 development service-well completions.

Exploratory and development drilling proceeded at a slightly lower rate than in 1958; however, the number of successful completions was higher with 162 oil wells and 83 gas wells compared with 151 oil and 80 gas wells in 1958. Drilling was distributed throughout the State with the greatest decline in the Denver-Julesburg basin where there were 95 less completions than in 1958. However, discoveries in the basin increased by 4 to 32. Development drilling added 110 new oil and gas wells to the area, mostly in Morgan, Washington, and Logan Counties. In southeastern Colorado, drilling increased slightly with three discoveries, one each in Baca, Kiowa, and Prowers Counties. Development drilling resulted in three successful gas wells in Kiowa County. In northeastern Colorado there were 14 discoveries, 5 in Rio Blanco County, 3 in Garfield County, 2 each in Routt and Mesa Counties, and 1 each in Moffat and Jackson Counties. Development drilling resulted in 35 successful wells; 18 were in Rio Blanco County and 8 in Moffat.

Activity in the Paradox and San Juan basins was largely in Montezuma and La Plata Counties where there were six oil and four gas discoveries. Almost the entire development was in the Ignacio-Blanco field in La Plata County where 33 gas wells were completed. One oil well was completed in the Red Mesa field.

Shale Oil.—Experimental work in processing oil from crude oil shale was continued by Denver Research Institute for Oil Shale Corp. Union Oil Co. began dismantling its pilot plant at Grand Valley upon conclusion of experimental work. However, planning for a substantial installation capable of producing shale oil in units of 10,000 barrels a day continued. In 1959, the low price of crude oil, resulting from a surplus of crude oil in world markets and the subsequent curtailment of domestic production, made extraction of shale oil commercially uneconomic.

METALS

Beryllium.—Sales of beryllium concentrate in Colorado dropped to 124 tons compared with 134 tons in 1958. However, an increase in the BeO content of the concentrate shipped in 1959 to 10.3 percent resulted in the same total value of sales for both years. The Boomer mine, in Park County, largest producer of beryllium-bearing material in the United States, was operated by U.S. Beryllium Corp. The mine was formerly operated by the Mile High Oil Co., and output in 1959 was 183,551 pounds of hand-cobbed ore containing 9.67 percent BeO and 193,670 pounds of low-grade concentrate with a BeO content of 4.45 percent. Shipments were 19 percent below 1958, but sales of low-grade concentrate of high-grade material were 2¼ times greater. The high-grade concentrate was shipped to the Government purchase depot at Custer, S. Dak., and the low-grade material was sold to Mineral Concentrates & Chemical Corp (Mincon) of Loveland. Mincon erected an oxide plant at Berthoud and planned to produce high-purity beryllium oxide. The beryllium hydroxide feed for the Berthoud plant was to come from the company's Loveland plant.

The Badger Flats area of Park County, especially the Boomer mine, was the center of prospecting, development, and production. The Federal Bureau of Mines began a trenching program in the Badger Flats area and planned to use a recently developed beryl detection device (berylometer) in connection with the project. This region, as well as the adjoining area, was prospected by a number of prominent mining firms. The new headframe and shaft at the Boomer mine were in operation, and underground mining was partly mechanized. The association of bertrandite with beryl made this vein-type deposit of particular interest to geologists and mining engineers throughout the industry. Beryl Ores Co. continued to purchase small lots of beryl from local mine operators. This ore and imported beryl were consumed at the company's Arvada plant.

Cadmium, Indium, and Thallium.—The American Smelting and Refining Co. recovered cadmium, indium, and thallium at its Globe smelter at Denver from flue dust, dross, and other byproducts material shipped from various company smelters. Output of these metals was not counted in State production totals because the origin was unknown.

Columbium-Tantalum.—No output of columbium-tantalum was reported from Colorado mines in 1959.

Copper.—Copper production decreased 30 percent (1,300 tons), but only an 18-percent decline ($401,000) was recorded in its value because of a higher weighted average price (30.7 cents per pound in 1959 compared with 26.3 cents in 1958). The State's principal copper producer was Idarado Mining Co. from its Treasury Tunnel-Black Bear-Smuggler Union group of mines in the Upper San Miguel district of San Miguel County. Copper was recovered from the ore as a coproduct of lead, zinc, gold, and silver. The New Jersey Zinc Co. was second to Idarado in copper output. Silver-bearing copper and lead-zinc ores from the Eagle mine at Gilman in the Red Cliff district of Eagle County were mined throughout the year by The New Jersey Zinc Co. Production of the silver-bearing copper ore was curtailed during the last half of the year pending negotiations for a new smelter outlet.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950-54 (average)	162	22	1,336	117,370	$4,108	2,942	$2,663
1955	120	14	908	88,577	3,100	2,772	2,509
1956	124	18	1,156	97,668	3,418	2,285	2,068
1957	115	16	1,111	87,928	3,078	2.788	2,523
1958	91	17	869	79,539	2,784	2,056	1,860
1959	65	16	769	61,097	2,138	1,341	1,213
1858-1959	----------	----------	(3)	40,485,302	910,863	764,842	598,718

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950-54 (average)	3,485	$1,793	25,397	$7,610	45,530	$13,446	$29,620
1955	4,323	3,225	15,805	4,710	35,350	8,696	22,240
1956	4,228	3,594	19,856	6,235	40,246	11,027	26,342
1957	5,115	3,079	21,003	6,007	47,000	10,904	25,591
1958	4,193	2,206	14,112	3,302	37,132	7,575	17,727
1959	2,940	1,805	12,907	2,969	35,388	8,139	16,264
1858-1959	295,784	92,004	2,743,243	323.058	1,893.578	350,054	2,274,697

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old slag, or tailings shipped to smelters during the calendar year indicated.

[2] Does not include gravel washed.

[3] Figure not available.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing [1]		Lode material sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Adams	------	5	------	1,260	$44,100	175	$158
Baca	1	------	325	------	------	51	46
Boulder	3	1	351	97	3,395	1,349	1,221
Chaffee	1	------	47	1	35	48	43
Clear Creek	5	------	6,899	1,936	67,760	25,502	23,081
Custer	1	------	8	3	105	23	21
Dolores	1	------	5,300	18	630	17,562	15,894
Eagle	1	------	268,205	2,824	98,840	576,760	521,997
El Paso	------	------	1	6	210	1	1
Fremont	1	------	31	------	------	16	14
Gilpin	4	2	384	60	2,100	170	154
Gunnison	2	------	43	2	70	1,021	924
Hinsdale	3	------	5,154	27	945	6,475	5,860
Jefferson	------	5	------	559	19,565	90	81
Lake	5	------	3,885	106	3,710	9,141	8,273
Mesa	1	------	38	------	------	52	47
Mineral	2	------	29,394	800	28,000	131,433	118,954
Moffat	------	1	------	4	140	------	------
Ouray	2	------	59	13	455	117	106
Park	2	------	2,395	80	2,800	26,992	24,429
Pitkin	2	------	36	------	------	30	27
Saguache	3	------	1,256	8	280	3,184	2,882
San Juan	3	------	6,049	310	10,850	7,303	6,610
San Miguel	3	------	369,260	20,675	723,625	528,883	478,666
Summit	2	2	2,056	122	4,270	341	309
Teller	17	------	68,147	32,186	1,126,510	4,013	3,632
Total: 1959	65	16	769,323	61,097	2,138,395	1,340,732	1,213,430
1958	91	17	868,903	79,539	2,783,865	2,055,517	1,860,347

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Adams	------	------	------	------	------	------	$44,258
Baca	6	$3,500	------	------	------	------	3,546
Boulder	(2)	92	2	$414	------	------	5,122
Chaffee	------	------	4	954	7	$1,495	2,527
Clear Creek	28	16,885	205	47,127	------	------	154,853
Custer	------	------	1	310	------	------	436
Dolores	3	1,750	325	74,865	362	83,214	176,353
Eagle	705	432,747	2,850	655,569	23,168	5,328,594	7,037,747
El Paso	------	------	------	------	------	------	211
Fremont	2	1,044	------	------	(2)	23	1,081
Gilpin	(2)	61	2	448	------	------	2,763
Gunnison	(2)	31	1	126	2	506	1,657
Hinsdale	(2)	276	3	644	------	------	7,725
Jefferson	------	------	------	------	------	------	19,646
Lake	6	3,930	117	26,887	------	------	42,800
Mesa	1	614	------	------	------	------	661
Mineral	63	38,651	1,615	371,335	1,275	293,204	850,144
Moffat	------	------	------	------	------	------	140
Ouray	(2)	31	3	644	3	794	2,030
Park	3	1,996	398	91,575	------	------	120,800
Pitkin	------	------	6	1,403	------	------	1,430
Saguache	3	1,903	58	13,237	15	3,508	21,810
San Juan	23	14,122	145	33,350	110	25,403	90,335
San Miguel	2,097	1,287,527	7,168	1,648,744	10,424	2,397,393	6,535,955
Summit	------	------	4	978	22	5,106	10,663
Teller	------	------	------	------	------	------	1,130,142
Total: 1959	2,940	1,805,160	12,907	2,968,610	35,388	8,139,240	16,264,835
1958	4,193	2,205,518	14,112	3,302,208	37,132	7,574,928	17,726,866

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[1] Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines.
[2] Less than 1 ton.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	24	69,182	32,541	5,694	500	8,100	----------
Dry gold-silver	4	606	37	1,451	1,100	19,500	----------
Dry silver	5	5,762	25	8,591	200	65,400	----------
Total	33	75,550	32,603	15,736	1,800	93,000	----------
Copper	5	17,378	2,357	383,912	1,179,700	111,300	200
Copper-lead	1	14	2	393	1,100	4,800	----------
Copper-lead-zinc and lead-zinc[2]	10	660,842	22,123	874,754	4,617,500	24,043,700	70,719,200
Lead	15	10,457	1,772	58,689	65,600	1,402,800	7,800
Zinc	2	67	--------	387	100	4,600	48,800
Total	29	688,758	26,254	1,318,135	5,864,000	25,567,200	70,776,000
Other "lode" material:							
Dry gold:							
Mill cleanings	(3)	1	6	1	----------	----------	----------
Old tailings	5	2,260	128	75	----------	100	----------
Copper-lead mill cleanings	(3)	7	2	152	400	3,100	----------
Lead:							
Cleanings	(3)	2	6	134	----------	800	----------
Mill cleanings	(3)	122	81	1,661	1,400	44,800	----------
Old slag	(3)	2,623	11	4,540	12,400	105,000	----------
Total	5	5,015	234	6,563	14,200	153,800	----------
Total "lode" material	65	769,323	59,091	1,340,434	5,880,000	25,814,000	70,776,000
Gravel (placer operations)	16	----------	2,006	298	----------	----------	----------
Total, all sources	81	769,323	61,097	1,340,732	5,880,000	25,814,000	70,776,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] From properties not classed as mines.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of materials processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	6,597	2,512	----------	----------	----------
Old tailings	89	29	----------	----------	----------
Total	6,686	2,541	----------	----------	----------
Cyanidation: Ore	31,423	3,994	----------	----------	----------
Total recoverable in bullion	38,109	6,535	----------	----------	----------
Concentration, and smelting of concentrates:					
Ore	18,282	905,438	4,685,800	24,497,600	70,763,800
Old tailings	39	46	----------	100	----------
Total	18,321	905,484	4,685,800	24,497,700	70,763,800
Direct-smelting:					
Ore	2,555	421,927	1,180,000	1,162,600	12,200
Cleanings	6	134	----------	800	----------
Mill-cleanings	89	1,814	1,800	47,900	----------
Old slag	11	4,540	12,400	105,000	----------
Total	2,661	428,415	1,194,200	1,316,300	12,200
Placer	2,006	298	----------	----------	----------
Grand total	61,097	1,340,732	5,880,000	25,814,000	70,776,000

Gold.—Output of gold decreased 23 percent (18,000 troy ounces in quantity and $646,000 in value). The Ajax mine (The Golden Cycle Corp.) was the leading producer followed by the Treasury Tunnel-Black Bear-Smuggler Union group of mines (Idarado Mining Co.) and the Cresson mine (The Cresson Consolidated Gold Mining and Milling Co.). The Ajax, Cresson, and other major gold producers—Deadwood, Vindicator, and Free Coinage—are in the Cripple Creek district, Teller County, which continued to be a principal gold-producing area. Seventeen mines in Teller County accounted for 53 percent of the State's gold output, and 3 mines in San Miguel County accounted for 34 percent. Production from three mines—the Ajax, Idarado, and Cresson—supplied three-quarters of the gold output of the State.

Iron Ore.—Brown iron ore (limonite) was produced from three operations. Stony Point Development, Inc., shipped ore from the Geneva mine in Clear Creek County to a manufacturer of paint on the east coast. Boyd Robinson produced a small quantity of ore from the Iron Lode No. 3 claim in San Miguel County for use as a soil additive in fruit orchards near Grand Junction. C. K. Williams & Co. shipped brown ore from the Iron Springs Placer claim, also in San Miguel County, for use in making paint.

Iron ore for The Colorado Fuel and Iron Corp. steel plant at Pueblo was obtained from company mines in Utah and Wyoming. A nationwide labor strike of steelworkers in July idled the company steel mill at Pueblo until November when it was reactivated under provisions of the Taft-Hartley Labor Relations Act. The company planned to install an $8 million oxygen steel converter at Pueblo with a capacity of 50,000 ingot tons per month. Other planned additions at Pueblo include: A new 69,000-volt loop transmission and distribution system, to cost about $2.2 million, a heavy-duty cooling bed for the 25-inch mill, substantial improvements to the 14-inch mill to increase efficiency and speed of operation, and increased capacity for the wire mill.

Pitkin Iron Corp. conducted exploration and development on a magnetite-ore deposit at an altitude of 11,000 feet on the side of Iron Mountain above Ashcroft in Pitkin County. Access and truck-haulage roads were being built from the existing roads to the deposits, and arrangements were being made for stockpiling the mined ore at the Woody Creek siding of the Denver & Rio Grande Western Railroad.

Lead.—Lead output dropped 9 percent in quantity and 10 percent in value. The weighted annual average price for lead was 0.2 cent per pound less than in 1958 (11.5 cents in 1959 and 11.7 in 1958). Three mining operations, Idarado Mining Co. (Treasury Tunnel-Black Bear-Smuggler Union group of mines), The New Jersey Zinc Co. (Eagle mine), and Emperius Mining Co. (Emperius mine), supplied 90 percent of the State's lead output. After 1½ years of inactivity, mining and milling of lead-zinc ore were resumed in January on a limited basis at the Rico-Argentine Mining Co. Rico mine in Dolores County. Former major lead producers in the State, the Keystone unit of American Smelting and Refining Co. and the Resurrection mine of Resurrection Mining Co., which were closed in mid-1957, remained idle throughout 1959.

Manganese.—All manganese ore and concentrate produced in Colorado in 1959 came from six mines, three in Saguache County, and one each in Fremont, San Miguel, and Summit Counties. Most of the output came from the Pershing claim (L. & M. Mining) in Saguache County and Cecile No. 1–5 (Ringwald-Hilton Mining Co.) in Summit County. All material was shipped under the Government carlot-purchase program administered by GSA. The quota was reached on this program on August 5, and all purchases were halted.

Molybdenum.—The entire production of molybdenum came from the Climax mine in Lake County operated by Climax Molybdenum Co., Climax Division, American Metal Climax, Inc. According to the company's annual report for 1959, production of ore from this mine increased 40 percent above 1958. Mine capacity was increased at the beginning of the year, and early in August a 7-day-per-week operation was adopted. Work was started on a program to maintain the long-term ability of the mine to produce a high capacity. Under this program, development work was begun on the third, and at that time the deepest, of the mining levels. The overall plan involved the progressive installation of underground and surface facilities that would permit ore production from this area by 1968 to replace output from the Phillipson level, which will be nearly mined out by that time. Most of the company-owned houses at the Climax mine site and in nearby Leadville were sold to John W. Galbreath & Co. which planned to resell them to the resident employees.

Rare-Earth Metals and Thorium.—Activity in rare earths and thorium was limited. Shipments consisted of only 9 tons of thorite mined from properties in Gunnison County. The thorite was sold to Rare Earth-Uranium Mining & Development Corp. at Canon City. This firm mined approximately 10 tons of yttrium-bearing ores for use at its Canon City plant. Although some oxides and concentrates were produced in 1959, no shipments were made.

Silver.—Silver production was 35 percent (715,000 troy ounces) less than in 1958. Most of the decline resulted from decreased output at two of the State's three leading silver producers—The New Jersey Zinc Co. (Eagle mine), the Idarado Mining Co. (Treasury Tunnel-Black Bear-Smuggler Union group of mines), and the Emperius Mining Co. (Emperius mine). The three operations supplied 92 percent of the State's silver output in 1959.

Tin.—Tin concentrate was recovered as a byproduct by treating the molybdenum flotation tailing from the Climax mill in a new plant completed in April 1958. Tungsten and pyrite also were recovered in the plant.[4] An accumulation of tin concentrate produced from 1956 through 1958 and most of that produced in 1959 was marketed and counted as production in 1959.

Tungsten.—Tungsten concentrate, produced by American Metal Climax, Inc., as a byproduct of molybdenum ore from the Climax mine, and tungsten concentrate, produced by Cold Spring Tungsten, Inc., from tungsten ore from the Cold Spring mine in 1957, were marketed and counted as production in 1959. Output declined in tonnage but increased slightly in value because of a price increase. In addition, Tungsten Mining Co. treated ore produced before 1959 from the Tungsten mine and recovered and stockpiled concentrate.

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[4] Burk, Snell G., New Plant Recovers Tungsten, Tin, and Pyrite from Moly Flotation Tailing: Mining World, vol. 21, No. 12, November 1959, pp. 38–43.

Uranium.—Production of uranium ore increased 11 percent in quantity but only slightly in value. Production came from 508 operations in 15 counties, compared with 564 operations in 16 counties in 1958. Major producing counties continued to be Montrose (43 percent), San Miguel (15 percent), and Mesa (14 percent).

Grade of the ore declined from 0.28 percent (5.7 pounds per ton) uranium oxide in 1958 to 0.26 percent (5.3 pounds per ton) in 1959. Purchase contracts between the Atomic Energy Commission (AEC) and mill operators specified the quantity of uranium oxide concentrate to be purchased, and mills operated on the basis of recoverable oxide rather than tons of crude ore processed. The lower grade ore processed in 1959 reflected the effect of the program that provided for delivery in 1962–66 of part of the production originally scheduled for pre-1962. Some lower grade ores were mined in preference to higher grade ores that would be more profitable to mine and process in 1962–66 and later when the purchase price of $8 per pound of uranium oxide becomes effective. In some mines the higher grade ores had been mined, and in the final stages of operation only lower grade ores were available.

TABLE 10.—Mine production of uranium ore [1]

County	1958				1959			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value [2]
Boulder	3	2,246	21,249	$95,186	3	(3)	(3)	(3)
Dolores	1	(3)	(3)	(3)	---	---	---	---
Fremont	9	7,931	46,093	193,673	13	13,826	73,394	$308,078
Garfield	1	13	28	63	---	---	---	---
Gilpin	---	---	---	---	2	(3)	(3)	(3)
Gunnison	---	---	---	---	1	(3)	(3)	(3)
Hinsdale	1	9	33	117	---	---	---	---
Huerfano	---	---	---	---	1	(3)	(3)	(3)
Jefferson	7	20,254	264,739	1,219,897	7	20,045	332,520	1,554.420
Mesa	100	151,857	845,264	3,542,653	80	145,205	826,660	3,490,693
Moffat	17	(3)	(3)	(3)	20	(3)	(3)	(3)
Montezuma	1	(3)	(3)	(3)	---	---	---	---
Montrose	261	420,338	2,275,618	9,427,008	260	449,422	2,415,038	9,986,967
Park	1	357	1,640	6,729	1	(3)	(3)	(3)
Pueblo	2	1,971	9,917	40,418	2	(3)	(3)	(3)
Rio Blanco	13	6,203	40,917	174,773	8	3,593	19,323	81,563
Saguache	6	104,946	465,932	1,894,911	8	134,547	462,586	1,554,929
San Juan	1	4	77	362	3	(3)	(3)	(3)
San Miguel	140	142,556	790,617	3,311,440	99	161,756	833,327	3,445,449
Undistributed	---	81,021	568,702	2,579,024	---	115,695	526,499	2,123,523
Total	564	939,706	5,330,826	22,486,254	508	1,044,089	5,489,347	22,545,622

[1] Based on data supplied to the Bureau of Mines by AEC.

[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.

[3] Figure withheld to avoid disclosure of individual company confidential data; included with "Undistributed."

The reserve of uranium ore on December 31, 1959, as determined by AEC, was 4.5 million tons containing 0.30 percent (6.0 pounds per ton) uranium oxide, compared with 4.4 million tons of the same grade on December 31, 1958. In December 1958, AEC began a survey of the ore reserve developed before November 24, 1958. Data from operations were to be submitted to the Commission by July 31, 1959. The purpose of the survey was to determine the quantity of uranium oxide derived from the ore that could be purchased by the Commission during the 1962–66 period. The data also were to be used to allocate or obligate ores from certain mines to certain mills. Processing mills at Grand Junction, Durango, Rifle, Uravan, Maybell, and Canon City and the upgrading plant at Slick Rock operated throughout the year. Expansion of the plant at Canon City to 200 tons daily capacity was authorized by AEC.

Vanadium.—Uranium ores in southwestern Colorado contain various amounts of vanadium; some are high enough in vanadium to warrant the cost of recovery. The vanadium in these ores was recovered at mills on the Colorado Plateau in Colorado. The recovered vanadium was credited to the State of origin. Vanadium recovered in 1959 from ores of Colorado origin increased 23 percent over 1958. The AEC applied more stringent specifications to acceptable uranium oxide concentrates, restricting them to concentrates containing no more than 2 percent vanadium oxide. As a result, several mills that did not recover vanadium were considering the installation of vanadium recovery equipment.

Research had demonstrated that vanadium might be an effective catalyst in devices designed to control the composition of automobile exhaust fumes. The problem of exhaust fumes had become of considerable concern in many communities, and future legislation designed to eliminate or alleviate these fumes appeared certain. Should the use of such devices become mandatory and no better method of control be developed, the consumption of vanadium could expand rapidly.

Zinc.—Zinc output declined 5 percent in quantity but increased 7 percent in value, because the weighted annual average price increased 1.3 cents per pound (11.5 cents in 1959 and 10.2 cents in 1958).

The leading zinc producers (in order of output) were The New Jersey Zinc Co. (Eagle mine), Idarado Mining Co. (Treasury Tunnel-Black Bear-Smuggler Union group of mines), and Emperius Mining Co. (Emperius mine), which together supplied 99 percent of the State's total zinc production.

NONMETALS

Cement.—The Ideal Cement Co., as a result of increasingly high operating rates at the Portland and Boettcher plants, established another Colorado sales record in 1959. Shipments of types I, II, III, and V cement were 6 percent above 1958, and nine kilns at the two plants operated 337 to 360 days. Transportation of the finished cement by truck to consumers accounted for 73 percent of the quantity shipped; the remainder was moved by rail. In addition to shipments to Colorado consumers, cement was sold to users in Kansas, Nebraska, New Jersey, New Mexico, Utah, and Wyoming.

Clays.—Although there was a 7-percent decline in the quantity of all types of clay mined, a higher average price for the material resulted in a 4-percent increase in the value of production. Fire clay furnished 271,000 tons (65 percent) of the total output and miscellaneous clay, the remainder. Jefferson County was the leading producer of both types of clay, followed by Douglas and Pueblo. Jefferson and Douglas Counties supplied raw material for the Denver market and Pueblo County for the Colorado Springs-Pueblo market. Great Western Aggregates, Inc., subsidiary of Ideal Cement Co., completed plans to erect a 300,000-cubic-yard-per-year shale processing plant west of Denver.

TABLE 11.—Production of clays, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Boulder	50,000	$87,500	(1)	(1)
Delta	(1)	(1)	----------	----------
Douglas	(1)	(1)	70,715	$183,910
El Paso	7,334	21,387	8,286	23,941
Fremont	9,006	35,380	14,801	62,346
Huerfano	6,516	35,838	7,590	41,745
Jefferson	237,611	531,664	231,389	558,765
Las Animas	7,637	16,190	7,298	18,975
Mesa	568	848	(1)	(1)
Pueblo	70,067	223,757	64,467	239,878
Undistributed	59,789	158,127	12,935	30,449
Total	448,528	1,110,691	417,481	1,160,009

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Feldspar.—Production of feldspar from Colorado pegmatites continued to decline. The Denver feldspar plant of International Minerals & Chemical Corp. closed early in 1959. Without this market outlet for their crude ore, nearly all of the small mines were shut down. M & S, Inc., continued to operate its Homestake Strip mine and shipped crude ore to the Salida mill of Western Feldspar Milling Co.

Fluorspar.—As a result of the termination of the Government Acid-grade fluorspar purchase program on December 31, 1958, production of fluorspar dropped 69 percent below the 1958 level. Ozark-Mahoning Co. shut down its Cowdrey, Jackson County, operation on January 31, and the only producer in the State for the rest of the year was Allied Chemical Corp. which operated its Burlington mine and Valmont mill in Boulder County.

Gem Stones.—The value of gem and ornamental stones collected was 14 percent greater than in 1958. The estimated $43,000 value of material collected in 1959 was based on reports received from people engaged in collecting and processing these materials. Gem and ornamental stones were collected in 23 counties. Turquois mined in Saguache County at the Villa Grove Turquoise Lode made this county the leading area in terms of value. Material valued at $15,200 was not distributed by county of origin because it could not be identified by location.

Gypsum.—Mining operations in Delta, Fremont, and Larimer Counties accounted for 106,000 tons of crude gypsum in 1959, 3 percent more than in 1958. Agricultural gypsum was produced by Atlas Mining & Manufacturing Co. from a deposit near Delta and by U.S. Soil Conditioning Co. from its pit near Salida, Fremont County. Fibreboard Paper Products Corp. mined gypsum for use at its Florence plant and for consumption by Ideal Cement Co. in manufacturing cement. The construction of a gypsum plaster plant at Florence was completed by Pabco in March. The new 45,000-ton-per-year mill was adjacent to the company's wallboard and lath manufacturing plant. The mill replaced the facility at the Ideal Cement Co. which was purchased by Pabco together with the gypsum mining properties but was operated by Ideal until the new plant was completed. Mineral industry activity in Larimer County included the operation of a gypsum mine near Fort Collins by E. W. Munroe, which supplied material to the Boettcher cement plant of Ideal Cement Co. and the production of gypsum products at the Loveland plant of United States Gypsum Co., which utilized gypsum from a nearby deposit.

Lime.—The lime industry of the State continued to consist of two small operations—one near Colorado Springs and the other at Glenwood Springs. Hydrated lime and quicklime were produced at both operations for use by the building trade and in chemical processes. Although output was more than double that of 1958, Colorado produced only about 1 percent of the lime consumed in the State. The lime plant of Basic Chemical Corp. burned on April 24; however, a new kiln was installed, and limited production was begun July 1.

Mica.—Mining of scrap mica in Colorado fell from 387 to 68 tons. This substantial reduction in output was a direct result of the closing in 1958 of the Pueblo mica mill of International Minerals & Chemical Corp. This mill was the principal market for independent producers. In addition, the closing of the Denver feldspar mill by the same company early in 1959 eliminated the possibility of marketing coproduct feldspar, and nearly all pegmatite mining operations were idle. Jolex Mica Co., with a grinding plant at Fort Collins, produced 35 tons of scrap mica from the Stein mine. Beryl Ores Co. purchased small lots of mica from two independent operators and ground the mica at its Arvada mill.

Perlite.—The Rosita mine of Persolite Products, Inc., continued to be the only source of crude perlite in Colorado, and output in 1959 was nearly 4½ times greater than in 1958. Persolite constructed a new grinding mill south of Florence and ceased having its ore custom ground at Silver Cliff. The ground perlite was trucked to the company's Florence plant for expanding. Western Mineral Products Co. of Denver expanded crude perlite from New Mexico mines.

Pumice.—Volcanic scoria was mined by four companies with pits in Costilla, Eagle, and Routt Counties. Concrete aggregate and building block manufacturing accounted for 32 percent of the total sales. The remainder was sold as railroad ballast, roofing aggregate, and highway cinders.

Pyrites.—Increased consumption of pyrite in sulfuric acid manufacture resulted in an 11-percent increase in output. Pyrite recovered as a byproduct of molybdenum ores by American Metal Climax, Inc., was shipped to the acid plant of Allied Chemical Corp. at Denver. Rico Argentine Mining Co. stated in its annual report to stockholders that 37,950 tons of pyrite was mined for its Rico acid plant between June 30, 1958, and July 1, 1959—37,659 tons from the Mountain Springs area and 291 tons from the Argentine area. The acid plant produced 39,529 tons of sulfuric acid, 100-percent basis, during the fiscal year. A new electrostatic hot precipitator was installed at the acid plant which was designed to remove fine dust from the circuit. However, unsatisfactory performance of the unit hindered acid production.

Salt.—Union Carbide Nuclear Co. continued to pump brine from its Montrose County well. The brine was used in treating uranium ores.

Sand and Gravel.—Highway construction in Colorado tapered off to a small extent, therefore sand and gravel production increased only slightly. Government-and-contractor output totaled 10.6 million tons and commercial output 10.3 million tons. Producers in 58 of Colorado's 63 counties reported production. Adams County was the leading source, followed by Arapahoe, Jefferson, El Paso, Weld, Pueblo, and Mesa, each of which produced over 1 million tons. These seven counties accounted for 52 percent of the output. The leading commercial producers included Brannan Sand & Gravel Co., Cooley Gravel Co., Rio Grande Gravel Co., Boise Cascade Sand & Gravel Co., Whitewater Sand & Gravel Co., Western Paving Construction Co., and Boulder Gravel Products Co.

A report[5] showed that Colorado ranked 24th in the Nation with 82.7 miles of all construction underway on the Federal interstate system in 1959. Of all mileage completed on the 41,000-mile superhighway network, Colorado ranked 14th with a total of 203 miles.

TABLE 12.—Production of sand and gravel in 1959, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Adams	3,229	$3,699	Larimer	476	$497
Alamosa	38	27	Las Animas	607	623
Arapahoe	1,521	1,938	Lincoln	107	53
Archuleta	380	302	Logan	240	145
Baca	13	8	Mesa	1,024	850
Bent	344	249	Mineral	178	164
Boulder	839	760	Moffat	262	214
Chaffee	103	80	Montezuma	861	1,018
Cheyenne	171	119	Montrose	699	576
Clear Creek	(1)	(1)	Morgan	486	414
Conejos	(1)	(1)	Otero	193	114
Costilla	2	2	Ouray	4	2
Crowley	1	1	Park	269	200
Custer	134	84	Pitkin	42	37
Delta	226	169	Prowers	126	79
Dolores	40	36	Pueblo	1,133	899
Douglas	321	247	Rio Blanco	327	225
Eagle	45	37	Rio Grande	15	10
Elbert	7	8	Routt	12	14
El Paso	1,315	1,072	Saguache	140	103
Fremont	101	79	San Juan	2	1
Garfield	35	24	San Miguel	1	1
Gilpin	4	2	Sedgwick	123	61
Grand	71	63	Summit	16	10
Gunnison	92	68	Washington	27	12
Huerfano	51	43	Weld	1,243	868
Jackson	206	85	Yuma	696	548
Jefferson	1,458	1,319	Undistributed	605	410
Kiowa	109	56			
Kit Carson	26	13	Total	20,897	18,817
La Plata	101	79			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

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[5] Bureau of Public Roads, Status of Federal-Aid Highway Programs, December 1959: Press release BPR 60-3.

TABLE 13.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Construction sand:				
Building	1,914	$2,084	1,914	$2,128
Paving	174	182	322	281
Railroad ballast	(1)	(1)	(1)	(1)
Fill	39	21	60	31
Other	6	10	16	16
Industrial sand:				
Blast	(1)	(1)	(1)	(1)
Engine	(1)	(1)	(1)	(1)
Filtration	(1)	(1)	(1)	(1)
Other	24	43	11	32
Total sand	2,157	2,340	2,323	2,488
Construction gravel:				
Building	2,154	3,041	2,494	3,092
Paving	3,606	3,268	5,113	4,876
Railroad ballast	----------	----------	(1)	(1)
Fill	160	102	311	322
Other	70	69	39	48
Miscellaneous gravel	----------	----------	22	31
Total gravel	5,990	6,480	7,979	8,369
Total sand and gravel	8,147	8,820	10,302	10,857
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	----------	----------	26	15
Paving	48	50	286	182
Total sand	48	50	312	197
Gravel:				
Building	243	209	125	83
Paving [2]	12,188	8,763	10,158	7,680
Total gravel	12,431	8,972	10,283	7,763
Total sand and gravel	12,479	9,022	10,595	7,960
ALL OPERATIONS				
Sand	2,205	2,390	2,635	2,685
Gravel	18,421	15,452	18,262	16,132
Total	20,626	17,842	20,897	18,817

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes fill and other gravel.

Stone.—Crushed limestone accounted for 88 percent of all stone quarried, but a decrease in output was largely responsible for the 4-percent decline in overall stone production. The cement industry was the principal consumer of limestone during the year. Large quantities also were used in road construction, as a flux, in manufacturing steel, and in refining sugar. Highway construction throughout the State and work at the U.S. Air Force Academy near Colorado Springs stimulated output of crushed miscellaneous stone and granite. The quarrying of both crushed and dimension sandstone was greater in 1959 than in 1958 as a result of increased use of crushed sandstone in road construction and gains in the use of dimension sandstone as rough construction, rough architectural, and dressed stone and for flagging. Crushed granite and marble were used as roofing chips, and the principal use of dimension granite and marble was as a monumental stone.

TABLE 14.—Production of stone in 1959, by counties

County	Short tons	Value	County	Short tons	Value
Adams	(1)	(1)	Mineral	828	$4,573
Alamosa	199	$1,389	Moffat	457	2,739
Arapahoe	251	1,316	Montezuma	13,204	58,542
Archuleta	1,651	9,327	Montrose	54,405	138,962
Bent	1,020	5,731	Morgan	1,847	12,523
Boulder	4,794	69,363	Otero	458	2,779
Chaffee	138,150	348,503	Park	239	1,912
Conejos	1,791	12,238	Phillips	300	1,545
Delta	300	1,523	Pitkin	345	1,233
Douglas	2,151	7,633	Prowers	779	4,283
El Paso	(1)	(1)	Pueblo	1,130	7,396
Fremont	1,187,985	1,631,810	Rio Blanco	456	2,739
Garfield	21,745	34,332	Routt	11	56
Grand	423	3,732	Summit	7,200	32,315
Gunnison	16,598	30,901	Teller	3,535	29,225
Huerfano	681	4,428	Weld	4,285	31,445
Jefferson	3,113	19,218	Yuma	4,277	27,367
La Plata	1,019	5,348	Undistributed	482,298	907,613
Larimer	827,780	1,929,813			
Las Animas	36,822	147,313	Total	2,823,669	5,536,518
Mesa	1,142	5,353			

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 15.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955	3,018	$51,329	----------	----------	226	$12,044	1,991,916	$2,766,544
1956	36,135	155,169	----------	----------	(1)	(1)	2,036,486	2,951,737
1957	18,367	111,425	3,500	$65,000	679	28,782	2,290,500	3,238,900
1958	10,837	82,060	----------	----------	2,058	186,012	2,701,750	4,004,500
1959	136,439	229,460	(1)	(1)	(1)	(1)	2,482,700	4,344,000

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	98,170	$629,289	55,689	$48,847	2,149,019	$3,508,053
1956	153,371	1,994,599	24,176	115,136	2,250,168	5,216,641
1957	121,619	721,595	3,800	2,600	2,438,465	4,168,302
1958	37,641	342,412	177,984	328,063	2,930,270	4,943,047
1959	43,381	294,015	161,149	669,043	2,823,669	5,536,518

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

Vermiculite.—Insulation and lightweight aggregate consumed the vermiculite exfoliated at the Denver plant of Western Mineral Products Co. Mines in Montana supplied the crude vermiculite to the Colorado mill.

TABLE 16.—Stone sold or used by producers, by uses

Use	1958		1959	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble……short tons	3,669	$48,225	6,968	$88,155
Rough architectural……cubic feet	34,702	72,766	41,387	80,395
Approximate equivalent in short tons	2,729		3,269	
Dressed architectural……cubic feet	41,237	206,336	12,612	28,420
Approximate equivalent in short tons	3,302		984	
Rough monumental……cubic feet	15,924	38,596	12,250	29,400
Approximate equivalent in short tons	1,339		1,029	
Dressed monumental……cubic feet	900	25,000	925	26,000
Approximate equivalent in short tons	76		78	
Curbing……cubic feet	281	851		
Approximate equivalent in short tons	22			
Flagging……cubic feet	26,580	24,003	30,084	29,087
Approximate equivalent in short tons	2,073		2,347	
Total dimension stone (quantities approximate in short tons)	13,210	415,777	14,675	281,457
Crushed and broken stone:				
Riprap……short tons	179,800	310,900	279,203	612,905
Metallurgical……do	217,600	400,500	281,900	620,100
Concrete and roadstone……do	796,800	1,426,800	366,127	871,205
Chemical……do	64,200	153,000	47,400	125,800
Miscellaneous……do	[1] 1,658,660	[1] 2,236,070	[2] 1,834,364	[2] 3,025,051
Total crushed and broken stone……do	2,917,060	4,527,270	2,808,994	5,255,061
Grand total (quantities approximate in short tons)	2,930,270	4,943,047	2,823,669	5,536,518

[1] Includes asphalt filler, coal dust, stone sand, cement, lime, terrazzo, uranium reagent, marble dust, roofing chips, sand and grits, marble whiting, plaster and cleaning sands, and paving and exposed aggregate panels.

[2] Includes asphalt filler, coal dust, filter beds, cement, lime, marble whiting, block filler, plaster and cleaning sands, terrazzo, and roofing chips.

REVIEW BY COUNTIES

Adams.—Production of sand and gravel at 14 operations was 3.2 million tons and accounted for 64 percent of the value of all minerals produced in the county. Brannan Sand & Gravel Co., Boise Cascade Sand & Gravel Co., Cooley Gravel Co., and Western Paving Construction Co. were the principal producers. Stone output consisted of crushed limestone (for road use) quarried by Colorado Materials Co. and crushed miscellaneous stone produced by crews of the State highway department.

Petroleum production from 20 fields represented 34 percent of the value of the county's mineral output. Of 23 exploratory wells completed, 5 new oilfields and 1 gasfield were discovered. Initial production ranged from 23 to 160 barrels of oil a day from the D and J sandstone members of the Dakota formation. The gasfield flowed 2.5 million cubic feet a day from the J sandstone. Of 18 completed development wells, 3 were successful. Major oil production came from the Badger Creek, Middlemist, Beacon, and Busy Bee fields.

Gold and silver were recovered as byproducts of six sand and gravel washing and screening operations. Kerkling & Slensker recovered gold and silver from sluicing gravel produced from Brannan Pits Nos. 8 and 10, F. S. Rizzuto Gravel pit and Boise Cascade Sand & Gravel pit. Cooley Gravel Co. recovered gold and silver from the North Plant pit.

TABLE 17.—Value of mineral production in Colorado, by counties

County	1958	1959 [1]	Minerals produced in 1959 in order of value
Adams	$4,600,957	$5,767,688	Sand and gravel, petroleum, stone, gold, silver, gem stones.
Alamosa	5,100	28,389	Sand and gravel, stone.
Arapahoe	1,648,500	1,939,016	Do.
Archuleta	366,030	638,927	Petroleum, sand and gravel, stone.
Baca [2]	81,800	11,946	Sand and gravel, copper, silver.
Bent	39,490	[2] 257,931	Sand and gravel, stone, petroleum.
Boulder	2,183,910	1,877,445	Fluorspar, sand and gravel, tungsten concentrate, stone, uranium ore, clays, peat, petroleum, gold, gem stones, silver, lead, copper.
Chaffee	812,747	604,925	Stone, feldspar, sand and gravel, zinc, gem stones, lead, beryllium concentrate, silver, gold.
Cheyenne	124,200	119,500	Sand and gravel.
Clear Creek	530,134	186,672	Gold, lead, silver, iron ore, copper, sand and gravel, gem stones.
Conejos	18,400	250,188	Sand and gravel, stone, gem stones.
Costilla	108,650	(3)	Pumice, sand and gravel.
Crowley	76,800	600	Sand and gravel.
Custer	34,092	(3)	Sand and gravel, perlite, lead, gold, silver.
Delta	474,138	531,119	Coal, sand and gravel, stone, gypsum.
Dolores	[4] 366,650	508,877	Pyrites, zinc, lead, sand and gravel, silver, copper, gold.
Douglas	267,561	439,006	Sand and gravel, clays, stone, gem stones.
Eagle	8,166,132	7,088,270	Zinc, lead, silver, copper, gold, sand and gravel, pumice, gem stones.
Elbert	160,650	8,000	Sand and gravel.
El Paso	2,704,096	2,021,915	Sand and gravel, stone, lime, coal, clays, gold, gem stones, silver.
Fremont	14,558,403	13,654,429	Cement, stone, coal, uranium ore, gypsum, petroleum, sand and gravel, clays, beryllium concentrate, feldspar, manganese ore and concentrate, copper, gem stones, zinc, silver.
Garfield [2]	[4] 265,915	191,838	Coal, stone, lime, sand and gravel, gem stones.
Gilpin	25,467	12,322	Peat, gold, sand and gravel, lead, silver, uranium ore, copper.
Grand	(3)	66,832	Sand and gravel, stone.
Gunnison	1,804,144	1,607,274	Coal, sand and gravel, stone, silver, thorite, zinc, lead, gold, gem stones, copper, uranium ore.
Hinsdale	3,556	7,725	Silver, gold, lead, copper.
Huerfano	674,232	446,764	Coal, sand and gravel, clays, stone, uranium ore.
Jackson	4,587,906	3,090,447	Petroleum, coal, sand and gravel, fluorspar.
Jefferson	3,286,762	3,474,806	Uranium ore, sand and gravel, clays, gold, stone, petroleum, beryllium concentrate, mica (scrap), gem stones, silver.
Kiowa	40,700	[2] 61,500	Sand and gravel, petroleum.
Kit Carson	23,600	14,300	Sand and gravel, gem stones.
Lake	32,947,213	47,740,170	Molybdenum, tungsten concentrate, pyrites, tin, lead, silver, copper, gold.
La Plata [2]	447,316	271,799	Coal, sand and gravel, petroleum, stone.
Larimer [2]	9,761,154	12,375,638	Cement, stone, petroleum, sand and gravel, gypsum, beryllium concentrate, mica (scrap).
Las Animas	8,526,026	9,049,697	Coal, sand and gravel, stone, clays, carbon dioxide.
Lincoln	213,000	53,200	Sand and gravel.
Logan [5]	17,216,740	15,187,300	Petroleum, sand and gravel.
Mesa [6]	4,814,165	4,875,734	Uranium ore, sand and gravel, coal, stone, copper, clays, gem stones, silver.
Mineral	640,099	1,020,577	Lead, zinc, sand and gravel, silver, copper, gold, stone, gem stones.
Moffat [5]	6,992,318	[4] 6,614,921	Petroleum, uranium ore, coal, sand and gravel, stone, gold, gem stones.
Montezuma	[4] 442,855	[2] 1,395,644	Sand and gravel, petroleum, stone, carbon dioxide, gem stones.
Montrose [4]	9,614,034	10,903,704	Uranium ore, sand and gravel, coal, stone, salt.
Morgan [5]	21,744,850	25,239,223	Petroleum, sand and gravel, stone.
Otero	9,600	116,479	Sand and gravel, stone.
Ouray	24,161	4,030	Sand and gravel, zinc, lead, gold, silver, copper.
Park	317,685	364,276	Sand and gravel, lead, beryllium concentrate, silver, gold, copper, stone, gem stones, uranium ore.
Phillips	----------	1,545	Stone.
Pitkin	(3)	(3)	Coal, sand and gravel, lead, stone, silver.
Prowers	112,400	86,183	Sand and gravel, stone, petroleum.
Pueblo	2,026,975	(3)	Sand and gravel, clays, uranium ore, stone.
Rio Blanco [7]	[8] 70,618,011	59,608,387	Petroleum, sand and gravel, uranium ore, coal, stone.
Rio Grande	72,137	10,000	Sand and gravel.
Routt	2,082,125	1,865,003	Coal, petroleum, pumice, sand and gravel, stone.
Saguache	[4] 2,057,193	1,776,590	Uranium ore, sand and gravel, manganese ore and concentrate, gem stones, lead, zinc, silver, copper gold.

See footnotes at end of table.

TABLE 17.—Value of mineral production in Colorado, by counties—Continued

County	1958	1959 [1]	Minerals produced in 1959 in order of value
San Juan	$245,473	[4] $92,816	Lead, zinc, copper, gold, silver, sand and gravel, uranium ore, gem stones.
San Miguel [4]	10,020,355	10,042,933	Uranium ore, zinc, lead, copper, gold, silver, iron ore, sand and gravel, manganese ore and concentrate, gem stones.
Sedgwick	47,560	[2] 60,900	Sand and gravel, gem stones.
Summit	91,076	72,015	Stone, manganese ore and concentrate, sand and gravel, zinc, gold, lead, silver.
Teller	1,535,847	1,165,950	Gold, stone, peat, silver, gem stones, feldspar.
Washington [5]	20,477,770	19,517,100	Petroleum, sand and gravel.
Weld [2]	9,534,362	9,507,101	Petroleum, coal, sand and gravel, stone.
Yuma	294,200	574,967	Sand and gravel, stone.
Undistributed [9]	27,638,904	31,830,751	
Total [10]	[8] 306,561,000	313,438,000	

[1] Natural gas and petroleum values are preliminary.
[2] Excludes natural gas.
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[4] Excludes vanadium.
[5] Excludes natural gas and natural-gas liquids.
[6] Excludes natural gas and vanadium.
[7] Excludes natural gas, natural-gas liquids, and vanadium.
[8] Revised figure.
[9] Includes natural gas, vanadium, natural-gas liquids, some sand and gravel, gem stones, and stone (1958) and values indicated by footnote 3.
[10] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

Arapahoe.—Eleven sand and gravel operations produced 1.5 million tons, making the county the second largest producer in the State. Cooley Gravel Co. with plants at Englewood and Littleton, Hall Sand & Gravel, Inc., Colorado Materials Co., and Herbertson Sand & Gravel Co. were the major producers. A small quantity of crushed miscellaneous stone was quarried and used in road construction.

Archuleta.—Petroleum output from three fields was 3 percent below that of 1958 and represented 51 percent of the value of all mineral production in the county. Seven exploratory wells were failures and one development well was successful.

Baca.—A new gasfield discovered in June flowed 1.5 million cubic feet a day from the Mississippian formation (Topeka) at a depth of 2,867 to 2,871 feet. Natural gas was produced at the Greenwood field.

Carrizo Enterprises, Inc., produced ore from the Ada mine from which copper and silver were recovered.

Bent.—Petroleum production from Bent's Fort and McClave fields was slightly below that of 1958. Four exploratory wells were failures. Carbon dioxide from wells in Las Animas County was processed at Ninaview. Natural gas was produced at the Lubers field.

Boulder.—Nonmetals comprised 92 percent of the $1.9 million of mineral production, a 14-percent decrease from 1958. Declines in the output of clays, fluorspar, stone, uranium, peat, petroleum, gold, silver, copper, and lead contributed to the drop. Beryl and feldspar were not produced in 1959. Allied Chemical Corp. operated its Burlington mine and Valmont fluorspar mill. Eldorado Clay Co. and Colorado Brick Co. mined fire clay and miscellaneous clay, respectively, for use in manufacturing brick and other clay products. Boulder Gravel Products, Inc., C & M Sand & Gravel Co., and Golden Transfer Co. produced most of the sand and gravel.

Petroleum production from the Boulder and Highland fields was 33 percent below that of 1958. Two exploratory wells were failures. Peat humus was mined for use as a soil conditioner and fertilizer admixture.

Uranium ore was produced at three mines and processed at mills in Colorado and Utah. Tungsten concentrate, produced by Cold Spring Tungsten, Inc., from ore from the Cold Spring mine in 1957 and then stored, was marketed in 1959.

Gold and silver were produced from the Geo. Sawhill Ranch gravel pit operated by Boulder Gravel Products, Inc. Small quantities of these metals, together with copper and lead, were recovered from ore produced from three lode mines—Gardner, Golden Princess, and White Raven.

Chaffee.—Although small quantities of gold, silver, lead, and zinc were recovered, the income of the mineral industry in the county was derived primarily from the production and sale of nonmetals. The production of crushed limestone from the Monarch quarry of The Colorado Fuel and Iron Corp. was the principal mining activity. M & S, Inc., continued to operate its Homestake feldspar quarry, and the crude ore was shipped to the Salida mill of Western Feldspar Milling Co. No mica production was reported, but Albert Cox produced a small quantity of beryl from Cox Gulch.

Harry Nylene made one shipment of gold- and silver-bearing lead-zinc ore from the Stonewall mine to the Midvale, Utah, mill of United States Smelting Refining and Mining Co.

Clear Creek.—Output of gold, silver, copper, and lead was reported from five mines, but most of it came from the Bald Eagle, operated by Jackpot Oil Co. and sublessee Milton George. Ore from this mine was treated in the Front Range custom mill at Idaho Springs, and the copper-lead concentrate was shipped to the American Smelting and Refining Co. Leadville smelter. The other four active mines were the Dixie, Franklin, Kitty Clyde, and Mint.

Brown iron ore was shipped by Stony Point Development, Inc., from the Geneva mine to a processor on the east coast for use in manufacturing paint. No production of feldspar or mica was reported in the county in 1959.

Costilla.—Output of scoria from the Mesita Hill deposit of Colorado Aggregate Co., Inc., continued to decline, and sand and gravel production consisted of a small quantity of paving gravel quarried by construction and maintenance crews of the Colorado Department of Highways.

Custer.—The Rosita perlite mine, operated by Persolite Products Co., was the only perlite mine in the State. The crude rock was shipped to Florence, Fremont County, for crushing and expanding. Contractors for the Federal Bureau of Public Roads and the State highway department quarried 133,700 tons of paving sand and gravel. Crews of the highway department produced 200 tons of paving gravel.

Delta.—Coal production, from seven mines, increased 40 percent and represented 68 percent of the value of all minerals produced. The major producer was the Juanita Coal & Coke Co. at the King mine.

The Delta Brick & Tile Co. did not produce clay in 1959. Sand and gravel output consisted of 28,300 tons quarried by the Delta Sand and Gravel Co. and 197,800 tons produced by construction crews and contractors for the Federal Bureau of Public Roads and the State and county highway departments. Atlas Mining & Manufacturing Co. of Delta continued to mine gypsum for agricultural purposes.

Denver.—The five oil refineries in the Denver metropolitan area operated throughout the year. Throughput was 11.6 million barrels, an increase of 8 percent over 1958. Rated capacity of the five plants was 34,600 barrels a day. No important plant expansions or improvements were made during the year.

Dolores.—Rico Argentine Mining Co. resumed limited production of lead-zinc ore from the Rico mine in January after 1½ years of inactivity. According to the company report to stockholders for the year ended June 30, 1959, ore production came from the Mountain Springs and Argentine areas of the mine, and development for lead-zinc ore included 947 feet of drifts and crosscuts, 1,353 feet of raises, and 279 feet of diamond drilling, all in the Mountain Springs area. The company also mined pyrite from the Mountain Springs and Argentine areas for use at its Rico sulfuric acid plant.

Douglas.—The continued growth of sand and gravel output was the principal reason for the 64-percent increase in the value of mineral production in the county; paving gravel for highway construction was the principal material quarried. Fire clay was mined from the Hogback mine of Robinson Brick & Tile Co., the Ringenberg mine of Denver Brick & Pipe Co., the Stevens pit of Stroud A. Whisenhunt, and the Helmer mine of Helmer Bros. Miscellaneous clay production was reported from the Diamond and Ute mines of Robinson Brick & Tile Co.

Eagle.—The Eagle mine at Gilman, operated throughout the year by the Empire Zinc Division, The New Jersey Zinc Co., was the State's leading zinc and silver producer, had the second largest output of copper and lead, and held fifth place in gold production. Development at this mine consisted of driving additional exploration drifts and sinking new inclines into the known ore reserve.

Scoria was mined at Dotsero by Lava Products, Inc., and at Carbondale by Roaring Fork Pumice Co. The prepared scoria was used in making building blocks, for roofing material, and in surfacing driveways.

El Paso.—Mineral production in El Paso County again was dominated by sand and gravel operations, which accounted for 53 percent of the value of all mineral output. The county ranked fourth in the State in quantity of sand and gravel produced. Aggregate produced by construction crews and contractors for the Colorado Department of Highways, the county highway department, and the city of Colorado Springs amounted to 56 percent of the 1.3-million-ton output; 10 commercial producers accounted for the remainder. Increased output of clay was reported. Robinson Brick & Tile Co. operated its Apache No. 7 mine, Standard Fire Brick Co. its Husted quarry, and National Clay Products Co. its National pit. Colorado Lime Co. produced quicklime and hydrated lime at its Pikeview plant for building, refractory, and chemical uses. Most of the stone quarried was crushed limestone. Colorado Materials Co. and Castle Concrete Co. produced limestone mainly for road construction, whereas Colorado Lime Co. used its limestone in the production of lime, asphalt filler, and rock dust for coal mines. No rare-earth or thorium ores were produced in 1959.

Coal production from the Franceville strip mine was 42 percent below that of 1958.

Fremont.—The value of mineral production in Fremont County dropped 6 percent. This decline was due almost entirely to a decrease in cement shipments from the Portland plant of Ideal Cement Co. The quantity of limestone quarried by Ideal dropped slightly, but reduced demand for stone in construction was the principal reason for the decline in stone output. Fibreboard Paper Products Corp. mined gypsum for use at its Florence wallboard and plaster plant and supplied the cement-retarder requirements of Ideal Cement Co. Production of fire clay reached 14,800 tons, 64 percent above 1958; George O. Stroup was the principal producer. Output also was reported by Irwin Clay Co., Ralph J. Pierce (from the Lawson and Salt Canyon deposits), and H. K. Porter Co., Inc. The last-named company produced and shipped fire clay to its Canon City refractories plant. Pegmatite mining at the Mica Lode yielded a small quantity of beryl and feldspar; no mica or columbium-tantalum was produced in 1959.

Coal production, from 18 underground and 2 strip mines, was 12 percent above 1958. Major producers were The Corley Co., Beer Coal & Construction, Inc., Vento Coal Co., and Canon Black Diamond Coal Co. Petroleum production from the Florence field, the second oldest in the United States, increased 44 percent over 1958. One exploratory well was a failure, but of 15 development wells completed, there were 4 successful oil wells and 1 gas well. Uranium-ore production from 13 operations was 74 percent above 1958. The major producers were Gunnison Mining Co., at Colorado Lease 519-Section 36 and Last Chance mines, and Seacol, Inc., at the Joan No. 2. Production was shipped to mills in Colorado and New Mexico for processing. The AEC approved a uranium oxide purchase contract with the Cotter Corp. and authorized increasing the daily capacity of the mill at Canon City to 200 tons. The contract, to become effective March 1, 1960, was to expire February 28, 1965. The contract under which Cotter Corp. began operating in mid-1958 was to expire February 29, 1960. The increased capacity of the plant would provide a market for numerous producers in the Colorado Front Range whose ores were committed to the Canon City mill.

Garfield.—Coal production from six underground mines declined 17 percent but still represented 54 percent of the value of all mineral production in the county. Major production was from the New Castle and Black Raven mines.

Natural gas was produced at nine fields; the Garmesa was the most important. One oilfield and two gasfields were discovered. The oil discovery pumped 19 barrels of oil a day from the Weber formation. The three gasfields, South Baxter Pass, Baldy Creek, and an unnamed field, flowed 1 million, 190,000, and 180,000 cubic feet a day, respectively. The producing formation at the South Baxter Pass field was the Morrison and at the other two fields, the Corcoran.

The Glenwood Springs limestone quarry operated by Frank H. Norberg Co. produced virtually all of the stone reported. The limestone was used in road construction, sugar refining, and lime manufacturing. Basic Chemical Corp. produced quicklime and hydrated lime at its Glenwood Springs plant.

Gilpin.—Four lode and two placer mines accounted for the small output of gold, silver, copper, and lead. The active lode mines were the Cyclops, Elk Valley, Glory Hole, and Katherine. Ore from the first two mines was shipped directly to the American Smelting and Refining Co. Leadville smelter; concentrate and bullion were produced and shipped from ore from the third mine; and concentrate was shipped from the fourth mine. The active placer mines were the Fool's Luck Placer and Smith Tyler. A small quantity of uranium ore mined at the Little Warrior mine and Root Ranch lease was shipped to the mill at Canon City for processing.

Peat humus was mined from deposits near Black Hawk for use as a soil conditioner and fertilizer admixture.

Gunnison.—Coal production from eight underground mines represented 94 percent of the value of all mineral production. Major producers were Minerals Development Corp. of Colorado, at the Somerset and Oliver No. 2 mines; Bear Coal Co., at the Bear mine; and Champion Coal Mining Co., at the Hawk's Nest mine. Production was 7 percent below that of 1958.

Gunnison Mining Co. operated its 200-ton-per-day acid-leach uranium mill at Gunnison. Small quantities of gold and silver were recovered at smelters from ore shipped from the Ruby Chief mine. Silver, copper, lead, and zinc were recovered from material shipped from the Napoleon mine dump.

Hinsdale.—Gold, silver, copper, and lead, valued at $7,700 and representing the county's entire mineral production, was recovered from ore and material produced from the Belle of the West mine and from the Lilley and Pelican mine dumps.

Huerfano.—Coal production, from eight underground mines, decreased 6 percent and represented 80 percent of the value of all mineral production. Leading producers were Delcarbon Coal Co., Skinner Coal Co., and Morning Glory Coal Co.

A small quantity of uranium ore from the Stumbling Stud mine was shipped to the mill at Canon City for processing.

The Chamblin mine of Standard Fire Brick Co. produced 7,590 tons of fire clay. Sand and gravel output, which dropped to 51,300 tons, was produced by crews of the Colorado Department of Highways and a contractor for the highway department.

Jackson.—Petroleum and coal accounted for 96 percent of the value of all minerals produced in the county. Petroleum output from the McCallum, Battleship, Canadian River, and South McCallum fields was 9,000 barrels above that of 1958. Natural gas was produced at the Canadian River field, and carbon dioxide was vented from the McCallum and South McCallum fields. One exploratory well produced a small quantity of oil; four other wildcat wells were failures. Of five development wells drilled, three were successful. Coal was produced at the Rosebud strip mine. Production was nearly four times that in 1958, when output was reported from two mines.

A small quantity of Acid-grade fluorspar was shipped from the Cowdrey operation of Ozark-Mahoning Co. as a result of cleanup activities. The mine and plant were shut down on January 31, 1959, and remained inactive throughout the rest of the year.

Jefferson.—Production of uranium ore, from seven mines, was approximately the same as in 1958 and represented 45 percent of the value of the entire mineral output. Major producers were Denver-Golden Corp., at the Schwartzwalter mine; and Foothills Mining Co., at the Wright lease. Most of the ore was shipped to the mill at Canon City for processing; smaller lots were shipped to mills at Rifle and Gunnison.

Petroleum production from the Soda Lake field decreased 50 percent.

Although the value of mineral production in Jefferson County was 6 percent above 1958, certain segments of the mineral industry were hard hit by the loss of outlets for their ore. The closing of the Pueblo mica and Denver feldspar mills of International Minerals & Chemical Corp. in 1958 and 1959, respectively, eliminated a major custom grinder of these pegmatite minerals. No feldspar, columbium-tantalum, fluorspar, rare-earth metals or thorium was produced in 1959. A small quantity of scrap mica was mined and shipped to Arvada for grinding, and 811 pounds of beryl was produced by three operators. Jefferson County was the third largest producer of sand and gravel in the State. Rio Grande Gravel Co., Asphalt Paving Co., and Table Mountain, Inc., were the principal quarry operators. The county was the major source of clays in Colorado, and production of fire and miscellaneous clays totaled 231,000 tons. The largest producer of fire clay was George W. Parfet Estate, Inc. (Rockwell-Apex-Green Mountain claims). The following companies or individuals also reported fire-clay production: John Harvey, H. M. Rubey Clay Co. (Rubey mine), Leland Doughty, Denver Brick & Pipe Co. (Caldwell and Strainland mines), Denver Fire Clay Co. (North and South Golden mines), and Robinson Brick & Tile Co. (Lariat mine). Miscellaneous clay was produced by Robinson Brick & Tile Co. (Chieftan mine), Lakewood Brick & Tile Co. (Lindsay mine), Denver Brick & Pipe Co. (Caldwell mine), Duane J. Bruno (Mt. Carbon mine), and Wesley Conda (State and Church pits).

Gold (600 troy ounces) and silver (90 ounces) were recovered as byproducts at five sand and gravel washing and screening plants. Kerkling & Slensker at the Rio Grande Gravel Co. pit and Robert R. Ray at the Suburban Sand & Gravel Co. and Clear Creek Rock Products Co. pits were the principal producers.

Kiowa.—Petroleum was produced at the Brandon field, a 1959 discovery, and natural gas at the McClave field. The new field, 18 miles northeast of the McClave field, pumped 65 barrels of oil a day from the Lansing-Kansas City formation at a depth of 3,682 to 3,684 feet. Three successful gas wells were completed in the McClave field; all produced from the Morrow formation.

Lake.—The State's entire output of molybdenum came from the Climax mine of Climax Molybdenum Co., Climax Division, American Metal Climax, Inc. According to the company annual report, expanded activity at the mine resulted in the production of 9.1 million tons of ore, 40 percent above the 1958 production of 6.4 million tons. Company officials reported that no new ore reserve was added during the year and that the ore reserve commercially minable at current costs and price levels was calculated at yearend at 463 million tons. This reserve, before dilution from mining, contained 2 billion pounds of molybdenum, and the full extent of the ore body had not been determined. According to the company, production of tungsten as a byproduct of treating molybdenum flotation tailing from the Climax mill was more than double the production in 1958. This increase reflected both the higher mine production and the improved recovery associated with full operation of the new and expanded byproducts plant completed in 1958. Virtually the entire output of tungsten was sold during the year. Tin and pyrite also were recovered as byproducts. Tin concentrate produced in 1956–58 and most of that produced in 1959 was marketed. Pyrite was sold to a Denver plant for use in the manufacture of sulfuric acid.

La Plata.—Natural gas was produced from the Ignacio-Blanco and Alkali Gulch fields, and petroleum from the Red Mesa and Barker Dome fields. Of 10 exploratory wells completed, 2 were oil wells in the Red Mesa area producing from the Dakota formation and 4 were gas wells in the Ignacio-Blanco area producing from the Mesaverde formation. Development drilling was particularly successful with 33 gas wells in the Ignacio-Blanco field and 1 oil well in the Red Mesa area from 36 wells completed. El Paso Natural Gas Co. operated its natural-gasoline absorption plant in the Ignacio field. Throughput averaged 144 million cubic feet of gas a day with a recovery of 29,200 gallons of natural gasoline, 42,000 gallons of butane, and 29,200 gallons of propane. Residual gas was marketed through company-owned pipelines to consumers in the Northwestern States. Coal was produced at 11 underground mines. Major producers were Victory Coal Co. and King Coal Co.

Vanadium Corp. of America operated its 750-ton-per-day uranium-vanadium processing plant at Durango. Crude ore came from company-owned mines and independent operators on the Colorado Plateau.

Larimer.—Increased shipments of cement from the Boettcher plant of Ideal Cement Co. was one of the principal reasons for the 27-percent gain in the value of county mineral production. Limestone used in making cement accounted for nearly all of the stone quarried in the county. Sixty-two tons of scrap mica was produced by Jolex Mica Co. at the Stein lode (35 tons) and by Robert Cullen at an unnamed mine (27 tons). Production from the Stein lode was ground at the Jolex Mica Co. plant at Fort Collins. E. W. Munroe mined gypsum for use as a cement retarder at the Boettcher plant of Ideal Cement Co. and United States Gypsum Co. quarried gypsum for use at its Loveland gypsum products plant. The Big Boulder, Clipper Beryl No. 1, Corral Pole No. 2, Emerald Gem, New Hope No. 20, Pole Hill, and Rita Beryl pegmatites were the source of 14,854 pounds of hand-cobbed beryl concentrate averaging 11.46 percent BeO. The bulk of the beryl was shipped to the Government purchase depot at Custer, S. Dak., but a small quantity was sold to Beryl Ores Co. of Arvada.

Petroleum production from seven fields was slightly below that in 1958. Major producing fields were the Fort Collins and Wellington. Four exploratory wells were unsuccessful; one development well was a producer.

Las Animas.—Coal production from eight underground mines was 10 percent below that of 1958, but the value of output represented 91 percent of the value of all mineral production in the county. The major producer was The Colorado Fuel and Iron Corp., operating the Allen and Frederick mines. The entire production of these two mines was used at the corporation's steel plant at Pueblo to manufacture coke. Activities were at a high rate the first half of the year, but because of the prolonged steel strike which began July 15 the mines were idle several months. Carbon dioxide from the Nina View field was transported by pipeline to a plant in Bent County for conversion into liquid carbon dioxide and dry ice.

Fire clay totaling 7,300 tons was mined from the Santa Fe mine of Scott-Ruiz Coal Co.

Logan.—Petroleum production from 80 fields was 9 percent below that of 1958. Major production was from the Cliff, Northwest Graylin, Yenter, and East Atwood fields. Of 65 exploratory wells, 9 (6 oil and 3 gas) were listed as discoveries. One well that flowed 300 barrels of oil a day from the D sandstone was later reclassified as a part of the Little Hoot field. Other wells produced from 7 to 43 barrels of oil a day from the D and J sandstones. The discovery well at the Dipper Gap gasfield flowed 7.5 million cubic feet a day from the D sandstone. Of 54 development wells completed, 19 were oil and 2 gas wells. Major development activity was in the Frasco, Little Hoot, and Dune Ridge fields. Natural gas from oil wells was processed at absorption plants operated by N. C. Ginther in the Lewis Creek, Little Hoot, Padroni, and Yenter fields and at the Kansas-Nebraska Natural Gas Co. plant in the Mount Hope field.

Mesa.—Uranium ore from 80 operations represented 72 percent of the value of all mineral production, although the quantity mined was 5 percent below that in 1958. Major producers were Climax Uranium Co., Climax Division, American Metal Climax, Inc., at 19 mines and Beaver Mesa Uranium Co. at 6 mines. Climax Uranium Co. recovered uranium oxide and vanadium oxide at its 300-ton-per-day plant at Grand Junction. AEC accepted delivery of 16,197 tons of uranium oxide, valued at $288 million, from 25 processing mills in States west of the Mississippi River. American Gilsonite Co. operated its processing plant near Fruita at a rate in excess of designed capacity and announced plans to further increase capacity. Union Oil Co. began dismantling its oil-shale pilot plant at Grand Valley after completion of experimental work in July 1958.

Coal production from six underground mines increased 5 percent over 1958. The major producer was Kerr Coal Co. operating the Cameo mine. Of the 74,358 tons produced, 72,014 tons was consumed at the Public Service Co. Cameo steam powerplant at the portal of the mine. Construction of a second 22,000-kw. unit was begun, and completion was expected in 1960. Dry natural gas was produced at the Asbury Creek, Bar X, Divide Creek, and Highline Canal fields.

A small quantity of miscellaneous clay was mined from a company-owned pit by Grand Junction Brick & Tile Co. for manufacturing brick.

Mineral.—Two mines, the Phoenix operated by Outlet Mining Co. and the Emperius operated by Emperius Mining Co., accounted for the entire output of gold, silver, copper, lead, and zinc. Emperius was the State's third largest producer of silver, lead, and zinc. Lead-zinc ore from this mine was treated in the company mill at Creede, and the lead and zinc concentrates were shipped, respectively, to the Leadville and Amarillo, Tex., smelters of the American Smelting and Refining Co.

Moffat.—Petroleum production, from 16 fields, increased 11 percent. Major producing fields were Danforth Hills, Iles, and Powder Wash.

Exploratory drilling resulted in 1 gas discovery from 23 completions. The discovery well at the Four Mile Creek field flowed 10 million cubic feet of gas a day from the Lance formation. A new producing horizon was found at the Moffat field. Initial production was 1,098 barrels of oil a day from the Weber formation at a depth of 5,880–5,888 feet. Of 12 development wells completed, 8 were successful (5 oil and 3 gas wells). Natural gas from oil wells was processed at refrigeration plants operated by Mountain Fuel Supply Co. in the Hiawatha and Powder Wash fields. Throughput at the two plants averaged 31 million cubic feet a day with a recovery of 3,000 gallons of natural-gas liquids. Residual gas was marketed through company pipelines to consumers.

Trace Elements Corp. produced uranium ore at 15 operations and operated its 300-ton-per-day processing plant at Maybell. Other producers shipped their ore to the mill at Maybell and to Rifle for processing.

Colowyo Coal Co. operated the Red Wing coal mine.

Montezuma.—Petroleum production from five fields increased twenty-sixfold. The gain resulted from discoveries at the Towaoc, Flodine Park, and Desert Canyon fields, all in the Paradox basin. The discovery well at the Towaoc field, completed in February, flowed 1,236 barrels of oil a day from the Paradox formation at a depth of 5,850 to 5,855 feet. At the Flodine Park field the discovery well, completed in April, flowed 192 barrels a day from the Ismay zone of the Paradox formation and 812 barrels a day from the Bluff zone of the Pennsylvanian. Two Miles north of the Towaoc field the discovery well at the Desert Canyon field, completed in November, flowed 280 barrels a day from the Paradox formation. One development well at the Towaoc field was successful, flowing 336 barrels a day. The part of the Paradox basin lying in Colorado where these discoveries were made, was scheduled for more intensive exploration and development in 1960. Carbon dioxide from wells in the McElmo field was processed by Colorado Carbonics Corp. at McElmo Creek to produce dry ice.

Montrose.—Mining and milling of uranium ore was the principal activity of the county mineral industry, and production of uranium ore from 260 operations represented 92 percent of the value of all mineral production. Output, which increased 7 percent over 1958, represented 43 percent of all uranium ore produced in the State. Major producers were Union Carbide Nuclear Co., Climax Uranium Co., Vanadium Corp. of America, Worcester Mines, and The Golden Cycle Corp. These five companies produced 92 percent of all uranium ore in the county. The ore was shipped to mills at Rifle, Uravan, Durango, and Grand Junction; to the Government-owned plant at Monticello, Utah; and to the upgrading plant at Slick Rock for processing.

Coal production increased nineteenfold. Ammon Nix operated the Independence mine. Edna Coal Co. operated the Navajo strip mine; the entire production was used at the Colorado-Ute Rural Electrification Administration (REA) steam powerplant at Nucla, which began operating late in 1958.

Morgan.—Petroleum output, from 44 fields, was 18 percent greater than in 1958 and was the principal mineral product. Major producing fields were Adena, Bijou, and Zorichak. Exploratory drilling resulted in seven discoveries—six oil and one gas. The Opal field, discovered in January, produced 28,190 barrels of oil. The discovery well pumped 125 barrels of oil a day from the D sandstone, and the discovery well at the Onyx field produced 35 barrels of oil and 750,000 cubic feet of gas a day from the J sandstone. A new producing horizon was found at the Jackson field where the discovery well pumped 100 barrels of oil a day from the D sandstone; previous production was from the J sandstone. A new gasfield, Canal, was discovered upon completion of the discovery well, which flowed 3.2 million cubic feet a day from the D sandstone. Discoveries were confined to a relatively small area in the west-central section of the county bounded on the west by the Bijou field complex and on the east by the Young field. Of 73 development wells completed, 35 were oil and 6 gas wells. Natural gas from oil and gas wells was processed at absorption plants operated by N. C. Ginther in the Goodrich and Vallery fields and Pure Oil Co. in the Adena field. Loffland Co. operated a refrigeration plant at the Fort Morgan field. Throughput of the four plants averaged 42 million cubic feet of gas a day to recover 136,200 gallons of natural-gas liquids.

Ouray.—Small quantities of gold, silver, copper, lead, and zinc were recovered from ore from the American Nettie mine by W. R. Nichols and from the Balm of Gilead mine by Green Rock Mining Co. A new mill was being built by Western-Knapp Engineering Co. for Camp Bird Colorado, Inc., at the Camp Bird mine near Ouray on the site of the old mill built in 1906.

Park.—The gold, silver, copper, and lead output in Park County came principally from lead ore from the Hill Top mine operated by Leadville Lead Corp. A small shipment of silver-bearing copper-lead ore was made from the Buckskin Gulch district by St. Jude Mining Co.

The Boomer mine was the source of most of the beryl mined in 1959. The Beryl Lode No. 3 mine, operated by L. A. Klabunde, produced 2,190 pounds of hand-cobbed concentrate, and the Mary Lee mine, worked by Mary Lee Mining Co., produced 2,798 pounds of beryl. The entire output of high-grade beryl was shipped to the Government purchase depot at Custer, S. Dak. No feldspar or mica was mined because of lack of markets.

Pitkin.—Coal production from four mines was 19 percent greater than in 1958. Thompson Creek Coal & Coke Corp. operated the Thompson Creek Nos. 1, 2, and 3 mines. Mid-Continent Coal & Coke Co. operated the Dutch Creek mine and produced coke in 25 beehive ovens at Redstone. An explosion at the Dutch Creek mine on August 15 caused extensive damage. No one was in the mine at the time of the explosion. After the mine and equipment were restored for safe operation under the supervision of State and Federal inspectors, the mine was reopened September 26.

Silver and lead was obtained from the Big Buck mine by Tanner & Prisley and the Mary Nos. 1, 2, and 3 claims by Charles Harris. Pitkin Iron Corp. explored a magnetite ore deposit 18 miles from Aspen near Ashcroft, built roads to the deposit, and arranged for stockpiling ore at the Woody Creek siding of the Denver & Rio Grande Western Railroad.

Prowers.—A new oilfield was discovered 2 miles south of the Barrel Springs field. The discovery well, completed in September, pumped

20 barrels of oil a day from the Morrow formation. Oil and gas production was recorded for the first time from the Barrel Springs field. One development well to the north was a failure.

Pueblo.—The clay industry in the county remained unchanged, except that output dropped to 64,500 tons from 70,000 tons in 1958. A shift in road-construction activities reduced the quantity of sand and gravel produced by 54 percent; the county dropped from first to sixth in production.

Uranium ore produced at the Cliff & Creek and George Avery mines by Cliff & Creek Uranium Co. was shipped to the mill for processing.

Rio Blanco.—Petroleum production from nine fields was 13 percent below that of 1958, largely because of a drop of more than 3 million barrels at the Rangely field. The waterflood and unit operation of the Rangely Weber pool progressed as planned; however, it will be some years before all injection wells are completed and production is stabilized. It was estimated that at yearend 1,450 of the 45,600 barrels produced daily was attributable to the waterflood operation. Four gasfields and 1 oilfield, from 15 exploratory wells completed, were designated as discoveries. Three of the gasfields were in the Sulphur Creek area; the output of gas was not reported. The discovery well at the Dragon Trail field, completed in August, produced 4.9 million cubic feet a day from the Mancos formation. A new producing horizon was found at the Pinnacle field. The discovery well, completed in August, pumped 43 barrels of oil a day from the Shinarump formation. Previous production at the field was from Dakota formations. Of 26 development wells completed, 14 were oil and 4 were gas wells. Principal producing fields were the Rangely and Wilson Creek.

Wesco Refining Co. operated its 1,700-barrel-per-day refinery at Rangely. Throughput was 38,755 barrels of crude oil, a drop of 24 percent from 1958. The California Co. operated its natural-gas plant in the Rangely field with an average daily throughput of 70 million cubic feet of gas to recover 90,000 gallons of natural-gas liquids. Residual gas was transported through pipelines to consumers. Natural gas from the Weber reservoir of the Rangely field unit area was used to repressure the reservoir and for field fuel. Daily production was 144 million cubic feet, of which 109 million was being injected into the reservoir. Coal produced at the Rienau and White River mines was 15 percent below that of 1958.

Uranium ore from eight operations was shipped to the processing plant at Rifle for treatment. The major producer was McAlester Fuel Co. at the Butter Fly No. 1 mine.

Routt.—Coal production from four underground and three strip mines was slightly below that of 1958 and represented 80 percent of the value of all mineral production. Major producers were P & M Coal Mining Co. (Osage strip mine), Edna Coal Co. (Edna strip mine), and Dry Creek Coal Co. (Cardinal underground and Old Quaker strip mines). Petroleum was produced at seven fields; principal fields were the Tow Creek and Curtis. Two new fields were discovered; Sage Creek, completed in September, pumped 90 barrels of oil a day from the Niobrara formation, and Grassy Creek field, completed in October, pumped 105 barrels of oil a day, also from the Niobrara. Two successful development wells were completed.

The McCoy Aggregate Co., of Steamboat Springs, continued to mine scoria for use as railroad ballast and in manufacturing building blocks.

Saguache.—Production of uranium ore from eight operations was 28 percent greater than in 1958 and represented 88 percent of the value of all mineral production in the county. Major producers were Gunnison Mining Co., at the Los Ochos mine, and Pinnacle Exploration Co., at the Erie 28 mine. Most of the ore produced was processed at the Gunnison Mining Co. plant at Gunnison. Shipments were also made to mills at Canon City and Salt Lake City, Utah.

Superior Mines Corp. produced lead and lead-zinc ores from the Antoro and Rawley mines and treated it in the company mill at Bonanza. Lead and zinc concentrates were shipped to the American Smelting and Refining Co. Leadville and Amarillo, Tex., smelters, respectively. Wm. J. Costello, operating the Rawley No. 2 mine on lease from Superior Mines Corp., shipped lead and lead-zinc ores directly to smelters.

Saguache was the State's leading county in shipments of manganese ore and concentrate. All of this material, 972 short wet tons averaging 42.4 percent manganese and valued at $81,000, came from three mines—Pershing, Lily Belle, and Wheel of Fortune Lode. It was shipped under the Government carlot purchase program, which was halted August 5 when the quota was filled.

San Juan.—Of the $93,000 value of mineral production in the county, $90,000 came from gold, silver, copper, lead, and zinc. Argyle Mining and Milling Co. was the major producer of these metals; the company mined lead and lead-zinc ores from the Pride of the West and Osceola mines and treated them in the company's Pride mill.

Marcy-Shenandoah Corp. leased the Sunnyside property near Silverton from the United States Smelting Refining and Mining Co. Standard Uranium Corp. purchased 50 percent of the assets of Marcy-Shenandoah and, under the name of Shenandoah, Ltd., began the work required by the lease of extending the American tunnel 4,800 feet, raising 480 feet, and drifting 4,000 feet to connect the tunnel with the existing workings of the Sunnyside property. Ore was to be treated in the Central mill rehabilitated by Marcy-Shenandoah in 1958. Construction of a new sampling plant was begun at the Central mill for handling small lots of custom ore. At yearend the company announced plans for mining and milling manganese-bearing material (rhodonite) from extensive deposits in San Juan County and producing manganese or its compounds from the concentrate recovered by milling.

Uranium-vanadium ore produced at three mines was shipped to plants at Durango and Gunnison for treatment.

San Miguel.—Most of the gold, silver, copper, lead, and zinc output, which accounted for 65 percent of the value of mineral production, came from the Idarado Mining Co. operation of the Treasury Tunnel-Black Bear-Smuggler Union group of mines. This group was the State's leading copper and lead producer and ranked second in output of gold, silver, and zinc. Newmont Mining Corp., which owned 74.2 percent of the Idarado company, reported in its annual report for 1959 that 369,050 tons of ore was milled from the group, compared with 382,100 tons in 1958. Production was intentionally reduced early in the year when lead and zinc prices were weak. The ore milled averaged 0.066 troy ounce of gold and 1.69 ounces of silver per ton, 2.29 percent lead, 0.65 percent copper, and 3.60 percent zinc. Additional ore developed during the year compensated for the ore mined. Thus the ore reserve was maintained at about 10 years' production at the 1959 rate, according to company officials.

The bulk of the State's iron-ore production (shipments) came from the Iron Springs Placer (C. K. Williams & Co.) and the Iron Lode No. 3 claim (Boyd Robinson) in San Miguel County. C. K. Williams & Co. used the brown iron ore for making paint, and Boyd Robinson marketed the ore for use as a soil additive.

Uranium-vanadium ore produced at 99 operations was 13 percent greater than in 1958 and represented 34 percent of the value of all mineral production. The ore shipped, which averaged 0.26 percent (5.2 pounds per ton) uranium oxide and 1.70 percent (34.0 pounds per ton) vanadium oxide, was processed at mills on the Colorado Plateau in Colorado, New Mexico, and Utah. Major producers were Union Carbide Nuclear Co., Dulaney Mining Co., Ortmeyer & Gomez, Shiprock, Ltd., and Gayno Mining Co. These four operators produced 88 percent of the uranium ore mined. Union Carbide Nuclear Co. operated its uranium upgrading plant at Slick Rock. Upgraded material was shipped to the mill at Rifle for further processing.

Summit.—Manganese ore was produced from the Cecile Nos. 1 through 5 claims by Ringwald-Hilton Mining Co. and marketed under the Government carlot purchase program.

Small quantities of gold and silver were recovered by placer mining at the Galena Placer by Marriott Carson Co. and at the Maggie by Blue Beach Mining Co. In addition, gold and silver was recovered by O. A. Sutton by re-treating mill tailing at the B & B and Baron claims. Silver Bull Mining Co. shipped lead and zinc ores from the Big Four Mine.

Teller.—Gold and silver output in Teller County, all from 17 active mines in the Cripple Creek district, was recovered at the Carlton mill. All mines shipped either mine ore or mine-dump material to this mill for treatment and recovery of the valuable minerals. The Ajax mine, operated by The Golden Cycle Corp., was the district's and State's leading producer of gold, followed by the Cresson (The Cresson Consolidated Gold Mining and Milling Co.) and the Deadwood-Vindicator mine (The United Gold Mines Co.). The Free Coinage, Grace Greenwood, Mollie Kathleen, Dexter, and El Paso mines also were major gold producers.

According to the 1959 annual report of The Golden Cycle Corp., 61,422 tons of mine ore and 8, 755 tons of dump ore, having an average value of $16.17 per ton for both company and custom ore, were treated at the company's Carlton mill, compared with 73,368 and 26,603 tons, valued at $15.25 in 1958. Production from the Ajax mine was 33,812 tons averaging $22.41 a ton, compared with 28,486 tons averaging $28.39 in 1958. Production came from the Queen of the Hills-Bobtail and the Newmarket vein systems. Low-grade ore was developed on the X–10–U–8 by lessees. According to company officials, the broken ore reserve was estimated at 40,482 tons on January 1, 1959, and at 40,535 tons on December 31, 1959. The reserve at yearend was lower in grade. The old wooden headframe at the Ajax mine was replaced by an 85-foot-high steel one. The new frame will result in better hoisting and permit the installation of more bins for an increased number of lessee operations.

The Cresson Consolidated Gold Mining and Milling Co. stated in its annual report for 1959 that the company produced 2,020 tons of ore averaging $4.46 per ton and that lessees produced 11,582 tons of ore averaging $11.01 per ton from the Cresson mine. Operation of the mine was terminated on August 31.

The United Gold Mines Co. reported in its annual report to stockholders that 5,651 tons of ore averaging $13.94 per ton was produced from the Deadwood mine, 154 tons averaging $15.82 per ton from the Vindicator mine, and 3,979 tons averaging $4.96 per ton from miscellaneous sources (principally from the Cycle dump). No work was done on the Black Diamond claim, which for several years before 1957 produced a fair tonnage of good ore. No scrap mica was mined. Carl Quist produced 50 tons of feldspar from the Black Cloud pegmatite mine early in the year.

Peat humus was mined for use as a soil conditioner and as an admixture in fertilizers.

Washington.—Petroleum represented the major mineral production. Production from 63 fields was slightly below that of 1958. Exploratory and development drilling were particularly successful. Of 73 exploratory wells completed, 7 were oil discoveries and 1 was a gas discovery. Of 75 development wells completed, 34 produced oil and 3 gas. New fields included the Coral, completed in July, which pumped 132 barrels of oil a day from the J sandstone; Hinge, completed in November, which pumped 84 barrels of oil a day from the D sandstone; Nugget, completed in February, which pumped 175 barrels of oil a day from the D sandstone; Centennial, completed in February, which pumped 183 barrels of oil a day from the J sandstone; Strand, completed in July, which pumped 50 barrels of oil a day from the J sandstone; Lindon, completed in December, which pumped 170 barrels of oil per day from the J sandstone; and Ruby, completed in March, which pumped 96 barrels of oil a day from the J sandstone. The gas discovery, unnamed and completed in August, produced gas at the rate of 1.4 million cubic feet a day, also a small quantity of distillate. Continental Oil Co. operated its 12 million-cubic-feet-a-day refrigeration plant at the Little Beaver field. Throughput averaged 6.5 million cubic feet a day to recover 48,000 gallons of natural-gas liquids.

Weld.—Coal and petroleum represented 91 percent of the value of all mineral production in the county. Coal production from six underground mines was 35 percent greater than in 1958. The Imperial Coal Co. operated the Eagle and Imperial mines; The Clayton Coal Co., the Lincoln and Washington mines; Boulder Valley Coal Co., the Boulder Valley No. 3 mine; and McNeil Coal Corp., the Sterling mine. Petroleum production from 41 fields declined 16 percent compared with 1958. Major producing fields were Pierce, Black Hollow, and New Windsor. Three gasfields were discovered from the 52 exploratory wells completed. The new fields, Border, Jasper, and Malpais, flowed 2.5, 2.3, and 1.5 million cubic feet of gas a day, respectively, from the D sandstone. Of 14 development wells completed, 2 were oil wells.

The Mineral Industry of Connecticut

By Stanley A. Feitler[1]

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PRODUCTION of most mineral commodities in Connecticut in 1959 was higher than in 1958, but output of sand and gravel for paving decreased 19 percent in quantity and 28 percent in value. This decrease resulted in a small net drop in total mineral output. Two commodities, stone and sand and gravel, accounted for 93 percent of the total value of mineral production. The value in New Haven County was $4.4 million—the highest in the State. Hartford County was second with $3.7 million. Litchfield and Fairfield Counties ranked next; each had a mineral output valued at about $1.5 million.

TABLE 1.—Mineral production in Connecticut[1]

Minerals	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate	(2)	(2)	13	$8
Clays	198,831	$299	279,937	368
Gem stones	(3)	3	(3)	5
Lime	28,996	464	(2)	(2)
Peat	1,764	11	2,090	13
Sand and gravel thousand short tons	5,019	5,479	4,749	4,912
Stone do	4,223	6,863	4,462	7,088
Value of items that cannot be disclosed: Feldspar, sheet mica (1958), and items indicated by footnote 2; excludes limestone used in manufacturing lime (1959)		89		536
Total Connecticut		[4] 13,128		12,930

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Weight not recorded.
[4] The total has been adjusted to avoid duplicating value of stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of miscellaneous clay for building brick recovered from the 1958 slump to a level about 10 percent below 1957. Increased construction of public and private buildings resulted in greater consumption of brick. The lightweight-aggregate manufac-

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

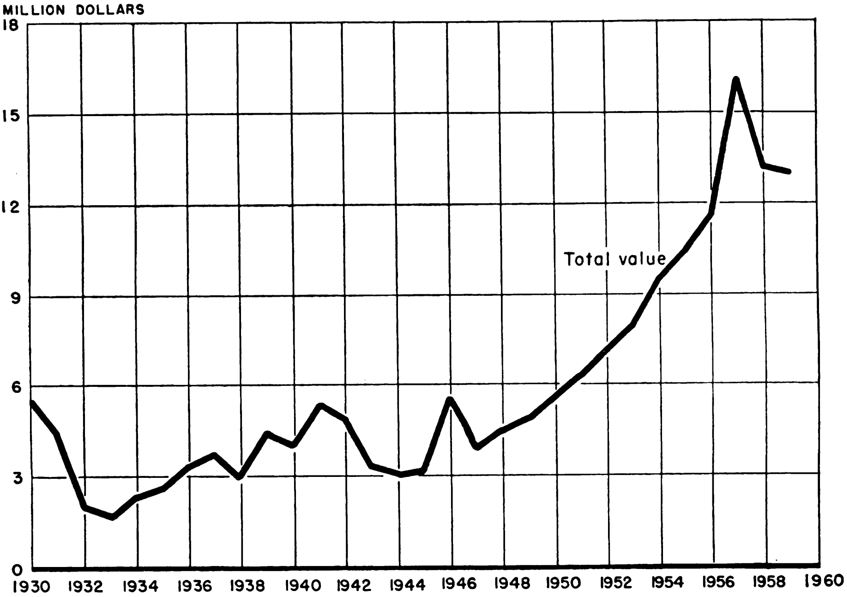

FIGURE 1.—Value of mineral production in Connecticut, 1930–59.

turing facilities of I. L. Stiles Corp. were reactivated by Plasticrete Corp. in the last quarter of 1959. The lightweight aggregate was made from overburden removed from the I. L. Stiles Corp. clay pit for use in lightweight cement blocks to offset a lag in the supply of expanded slag due to the steel strike. Several other clay pits remained idle during the year. One hundred and eighty-six men were employed full time, and no fatal accidents occurred.

Feldspar.—Output of crude feldspar exceeded that for the preceding 4 years and was 24 percent higher than in 1958. The average value was $8.46 per long ton, or $1.15 higher than in 1958. Open-pit-mining methods and some hand sorting were used by the two operating companies. Operations at the Manchester feldspar grinding plant of Orford Soap Co. were terminated. For many years the plant ground feldspar, for use as an abrasive in soap, from ore produced in New Hampshire by Whitehall Co., an affiliate. Feldspar mines and grinding plants reported no lost-time injuries during the year.

Gem Stones.—The value of gem stones, including mineral specimens, was higher than in 1958. Gem and mineral collectors were especially active in Fairfield, Litchfield, and Middlesex Counties. Most of the value was in mineral specimens collected by members of Connecticut and out-of-State mineral and lapidary clubs. The pegmatite dikes of Fairfield and Middlesex Counties continued to attract many gem and mineral hobbyists.

Lime.—Both the quantity and value of lime production increased over 1957 and 1958. Most of the increase was in quicklime which was used principally in the manufacture of calcium and magnesium at Canaan. Approximately 85 percent of the lime output was consumed within the State. Small quantities of hydrated lime were shipped to Massachusetts and New York.

Mica.—No mica production was reported in 1959. Small quantities of strategic-grade mica had been mined in each of the preceding 4 years.

Sand and Gravel.—Most of the 5-percent decrease in production of sand and gravel in 1959 was due to lower consumption of paving material. The average value of building sand was 88 cents, down 11 cents per ton; that of commercially produced paving sand was 91 cents, down 17 cents per ton. The average value of building gravel was up 13 cents to $1.52 per ton, and that of paving gravel was unchanged at $1.19. Sand and gravel, washed, screened, or otherwise prepared, increased from 79 percent of the total in 1958 to 84 percent. The industry employed 364 men, whose productivity rate was 7.6 tons per man-hour. Commercial sand and gravel was delivered mainly by truck; only 4 percent was shipped by railroad.

TABLE 2.—Sand and gravel sold or used by producers, by classes of operations and uses

Uses	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Structural	1, 194, 636	$1, 182, 724	1, 123, 080	$985, 801
Paving	1, 377, 768	1, 497, 269	1, 255, 582	1, 143, 221
Railroad ballast	(1)	(1)	7, 445	2, 803
Fill	64, 440	33, 232	(1)	(1)
Other	(1)	(1)	100, 924	109, 818
Gravel:				
Structural	861, 526	1, 199, 172	948, 418	1, 440, 543
Paving	914, 868	1, 086, 940	609, 458	727, 786
Fill	261, 386	208, 819	207, 271	140, 116
Other	127, 816	165, 849	171, 437	205, 603
Undistributed [2]	113, 470	65, 968	154, 028	88, 848
Total	4, 915, 910	5, 439, 973	4, 577, 643	4, 844, 539
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	62, 505	23, 210	72, 763	26, 705
Gravel: Paving	40, 400	15, 501	98, 313	41, 219
Total	102, 905	38, 711	171, 076	67, 924
Grand total	5, 018, 815	5, 478, 684	4, 748, 719	4, 912, 463

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes filter sand and data indicated by footnote 1.

Stone.—Basalt, limestone, granite, and sandstone, listed in order of decreasing tonnage, were produced. Stone was quarried from all counties except Middlesex and Tolland. Basalt, totaling 94 percent of the stone tonnage, was quarried in Hartford, Litchfield, and New Haven Counties for use as concrete aggregate, roadstone, riprap and railroad ballast. Basalt was delivered to its destination by truck (75 percent), by waterway (18 percent), and by railroad (7 percent). Limestone, mined in Fairfield and Litchfield Counties, was used principally as agstone and in manufacturing lime. A little limestone was used in stucco, in construction, and as a filler. Crushed granite was used principally for concrete aggregate, roadstone, and riprap. Ground silica (quartz) continued to be produced principally for use in making special glass; small quantities were used in foundries, as an abrasive, and for roofing granules. Stone quarries and preparation plants employed 450 men and recorded 32 lost-time accidents during the year.

TABLE 3.—Stone sold or used by producers, by uses

Uses	1958		1959	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Dimension stone (quantities approximate in short tons)	5,892	$150,737	6,730	$174.
Crushed and broken stone:				
Agstone	61,536	274,691	(1)	(1)
Concrete, roadstone	[2] 3,567,395	[2] 5,240,448	4,084,999	5,916,239
Quartz (ground)	25,000	222,000	(1)	(1)
Railroad ballast	(1)	(1)	58,002	70,641
Riprap	----------	----------	132,679	153,751
Undistributed	563,066	974,642	179,727	773,415
Total	4,222,889	6,862,518	4,462,137	7,088,472

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Incomplete figure, part not included is combined with "Undistributed."

METALS

Smelters in Fairfield, Hartford, and New Haven Counties continued to process a wide variety of primary and secondary nonferrous metals; castings from these metals were produced throughout the State. Metallurgical research with rarer metals such as rhenium, osmium, and zirconium was continued during the year. Steel was produced at one plant in Fairfield County. Ferrous castings from primary and secondary metals were produced in numerous foundries in the State.

Ferrous scrap dealers were active in 1959. The main yards were at Bridgeport, East Hartford, Meriden, and New Haven. Principal grades of prepared iron and steel scrap received by reporting dealers, in order of decreasing tonnage, were Low Phosphorus, No. 2 Heavy Melting, Cast Iron Other Than Borings, and No. 1 Heavy Melting.

Beryl.—Production of beryl was about the same as in 1958. Hand-sorted beryl concentrate, averaging 12.14 percent BeO, was sold to the GSA Depot at Franklin, N.H.

FUELS

Coke.—Connecticut Coke Co. (New Haven) operated a merchant coke plant using 70 Koppers-Becker ovens with an annual capacity of 410,000 tons. The coke was used by gas plants, foundries, other industrial plants, and for residential heating. Byproducts of coking were ammonium sulfate, crude coal tar, crude light oil, and intermediate light oil.

Peat.—Peat was produced from four bogs in 1959—two in Middlesex County and one each in Hartford and Tolland Counties. Tonnage was greater than in 1958, but the price dropped from $6.38 to $6.27 per ton. The entire output of peat was used as a soil conditioner.

REVIEW BY COUNTIES

Production of sand and gravel by Government-and-contractor operations was reported in Hartford County by the town of South Windsor and the Department of Public Works at Bristol. The Connecticut State Highway Department reported sand and gravel output from unspecified counties.

Fairfield.—The county was the leading producer of sand and gravel, with a total of 1.2 million tons. Eighty-four percent of the county output was prepared material used mainly for building and paving. Producers throughout the county reported a total of 92 employees working 162,000 man-hours. Limestone used mainly for agstone was quarried near Danbury by Connecticut Agstone Co. The company also produced limited quantities of crushed stone for use as flux, concrete aggregate, and roadstone. Gems and mineral specimens were collected near Trumbull, Branchville, New Hartford, and Roxbury.

Carpenter Steel Co. of New England (Bridgeport) continued to produce blooms, billets, strip, and bars. The plant operated two electric furnaces having an annual capacity of 84,000 tons. Bridgeport Brass Co., Bridgeport, conducted research to develop new uses for hafnium, cobalt, tantalum, zirconium, and titanium.

TABLE 4.—Value of mineral production in Connecticut, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Fairfield	(1)	$1,494,730	Sand and gravel, stone, gem stones.
Hartford	$3,443,759	3,703,447	Stone, sand and gravel, clays, peat, gem stones.
Litchfield	1,368,018	1,663,146	Stone, lime, sand and gravel, gem stones.
Middlesex	413,721	553,517	Sand and gravel, clays, feldspar, peat, gem stones.
New Haven	4,069,602	4,367,394	Stone, sand and gravel, clays, beryl, gem stones.
New London	(1)	507,855	Stone, sand and gravel.
Tolland	(1)	(1)	Sand and gravel, peat.
Windham	(1)	(1)	Sand and gravel, stone.
Undistributed	[2] 3,832,919	63[illegible],424	
Total	13,128,000	12,930,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes sand and gravel and gem stones (1958) unspecified by county.

Hartford.—The county continued to rank second among the stone-producing counties and accounted for 43 percent of the State's total tonnage. Production of crushed basalt (traprock) in the county totaled 1.9 million short tons, a 13-percent increase over 1958. Ninety-seven percent of the county's basalt output was marketed for concrete aggregate and roadstone; the remainder was sold for riprap. Six quarries were active—two near Plainville and one each near East Granby, Farmington, New Britain, and Newington. Limited quantities of rough dimensional granite were produced by Tower Hill Granite Co. and T. A. Armando, both near Glastonbury. The county ranked second as a producer of sand and gravel with over 1 million tons. Eighty-five percent of the output was washed, screened, or otherwise prepared, mainly for building and paving use. Quantities of filter sand and fill sand and gravel also were produced. Producers throughout the county reported a total of 80 employees working 150,000 man-hours for the year. Average value per ton reported by producers was $0.94.

Hartford County led the State in production of clay, reflecting increased use of brick in construction. Although only three brick companies were active, both tonnage and value were higher than in 1958. Humus peat was recovered near Manchester by Woodrow Clifford. Datolite and zeolite minerals were collected near Farmington. Amethyst was found near Southington and azurite near Farmington.

Litchfield.—Production and value of limestone produced in the county increased. High-magnesium limestone was quarried and crushed near Canaan by New England Lime Co., mainly for its nearby lime kilns. The company also produced quantities of limestone for use as agstone, whiting, and filler material. Most of the lime was used in manufacturing calcium and magnesium by Nelco Metals Inc. (Canaan), a subsidiary company. Finishing and mason's lime, as well as agricultural lime, also were produced by the company. Other limestone producers were U.S. Gypsum Co. at Falls Village and Conklin Limestone, Inc., at Canaan. Output from these two quarries was marketed principally for agstone. Crushed basalt, used chiefly for concrete aggregate and roadstone, was quarried near Torrington by Building Materials, Inc. Eighty percent of the output of sand and gravel was prepared and marketed for use as structural and paving material. Limited quantities were sold for sanding roads and miscellaneous uses. Various minerals, including galena, pyrite, fluorite, and several species of zeolites were collected near Thomaston Dam.

Middlesex.—Building and paving material was the chief product of the county's sand and gravel producers. Production was reported mainly near Deep River, Madison, Portland, and Clinton. Most of the county output (83 percent) was prepared material. The Michael Kane Brick Co. of Middletown reported increased production of miscellaneous clay for use in manufacturing building brick. Crude feldspar was recovered from an opencut pegmatite mine near Portland by Eureka Feldspar Mining & Milling Co. The output was processed at a nearby mill for use in pottery. Worth-Spar Co., Inc., mined potash-type feldspar from an opencut in a zoned pegmatite at Cobalt, trucking the material to its mill for processing into an abrasive used in soap. Saybrook Peat (formerly J. Werden Clark) recovered humus peat from a bog near Old Saybrook. Reed-sedge peat was produced near Saybrook by E. C. McGuire and Sons. The many pegmatite dikes near Middletown, Portland, Haddam Neck, Haddam, and East Haddam were a source of numerous gem and mineral specimens. Material collected included microlite, samarskite, lepidolite, and several varieties of beryl.

New Haven.—The county continued as the State's leading stone-producing area; output was reported from seven basalt quarries and one granite quarry. Stone produced in the county accounted for 48 and 47 percent, respectively, of the output and value of all stone produced in the State. Ninety-four percent of the basalt output of the county was marketed as concrete aggregate and roadstone; the remainder was sold for use as riprap and railroad ballast. Basalt was shipped by truck (52 percent), water (35 percent), and rail (13 percent) from quarries near Hamden, Meriden, New Haven, North Branford, and Wallingford. Granite for rough architectural use was quarried at the Stony Creek quarry of Castellucia & Sons, Inc. (Branford). The county ranked third among the State's sand and gravel producing areas. Most of the output came from the southern part of the county and was used for structural and paving purposes.

The Stiles Corp. at North Haven produced more miscellaneous clay for brick than in 1958. For the sixth consecutive year Burritt R. Curtis produced beryl at the Southford Quarry, Southbury. More than 12 tons of hand-sorted beryl was sacked and sold to GSA at the Franklin, N.H., depot. Gem and mineral specimens were reported to have been collected near Cheshire, Southbury, North Haven, and Wallingford; zeolites, barite, chalcocite, and amethyst were recovered. National Gypsum Co., Buffalo, N.Y., continued to calcine crude gypsum shipped from outside the State and to manufacture plasterboard in its recently enlarged plant at New Haven.

The American Brass Co., Waterbury, completed plans for constructing a $1.5 million research center. The new center was planned to include metallurgical, corrosion, and chemical laboratories, as well as pilot-plant equipment for experimental production of new products. Chase Brass and Copper Co., Inc., Waterbury, long a producer of copper, copper alloys, and aluminum, also produced titanium products; zircon-alloy tubing; and wrought rhenium rod, strip, and tubing.

New London.—Connecticut Silica Co. (formerly Lantern Hill Silica Co.) quarried and crushed quartzite near North Stonington. Output was below the level of 1958. The ground silica was used in special glass and as foundry, abrasive, roofing-granule, and plaster sand. During the year the company added crushing and screening equipment to increase capacity by early 1960. Crushed granite, used for concrete aggregate, roadstone, and riprap, was produced at Montville by Barrett Division of Allied Chemical Corp. Rough monumental stone was produced from granite quarries by E. Locarno & Sons and Golden Pink Granite Quarry Co., both near Niantic. Various types of building stone, monumental stone, and riprap were produced by Millstone Granite Quarry, Inc., Waterford. Sand and gravel was recovered chiefly from the Bozrah, Montville, and Niantic areas.

Tolland.—Sand and gravel, used chiefly for building and paving, was recovered from operations near Bolton and Rockville. Humus peat was produced by Bonair Peat Co. near Ellington.

Windham.—Curbing and rough dimension granite were quarried near Oneco by R. E. Marriot & Sons. Building and paving sand and gravel were produced at plants near Danielson, Putnam, and Wauregan. Sixty-five percent of the tonnage was shipped by truck; the remainder was shipped by rail.

The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the Delaware Geological Survey.

By Robert D. Thomson[1]

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DELAWARE mineral production in 1959 increased 12 percent, totaling $1.3 million. Sand and gravel and stone production increased in value, whereas clay output declined. Sand and gravel continued as the leading mineral commodity.

Employment reported by the mineral industries totaled 105 production employees working 219,400 man-hours, increases over 1958 of 8 and 16,600, respectively.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of clay continued downward owing mainly to a decline in the demand for building brick. Miscellaneous clay produced in New Castle County was used at a local brick plant.

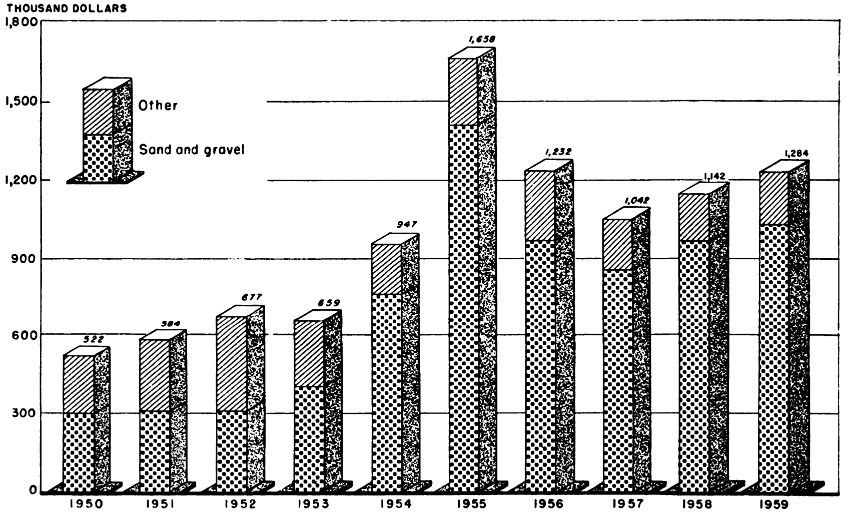

FIGURE 1.—Value of mineral production in Delaware, 1950–59.

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[1] Supervisory commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production of Delaware[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Sand and gravel	1,090	$962	1,241	$1,071
Value of items that cannot be disclosed: Clays and stone		180		213
Total Delaware		1,142		1,284

[1] Production as measured by mine shipments and mine sales (including consumption by producers).

Fluorspar.—Acid-grade fluorspar for manufacturing chemicals was produced at Wilmington by the St. Lawrence Fluorspar Corp. Most of the fluorspar processed by the plant was imported.

Sand and Gravel.—Sand and gravel continued to be the principal mineral industry in Delaware, commercial production increasing 14 percent. Sand was marketed as building, paving, and engine sand and sand for fill. Gravel was marketed for building gravel, paving gravel, and fill material. Approximately 83 percent more sand and gravel was marketed as building material in 1959 than in 1958 and 1 percent more as paving material. Of the total tonnage, sand and gravel for building purposes represented 74 percent. Fifty-one percent of the sand and gravel was washed or screened, and the entire output was transported by truck.

Sand and gravel was produced under contract to government agencies for State highway construction and runways and buildings at Dover Air Force Base.

The productivity rate was 57 tons per man-shift at stationary-plant sand and gravel operations and 49 tons per man-shift at portable operations.

Stone.—Granite, the only stone produced in the State, was crushed and marketed for use as concrete aggregate and sandstone. The greater part of the demand for aggregate in road building continued to be supplied from mining operations in other States.

Sulfur.—Tidewater Oil Co., at its Delaware City Refinery, continued to use the Claus process to recover sulfur from crude oil received from other States and foreign countries.

TABLE 2.—Employment in the sand and gravel industry

	1958			1959		
	Men working daily	Average active days	Man-hours worked	Men working daily	Average active days	Man-hours worked
Stationary	49	261	106,060	48	256	98,408
Portable	26	232	52,691	29	252	56,580
Combination				6	250	12,000
Total	75	251	158,751	83	254	166,988

METALS

Open-hearth furnaces were operated at Claymont by the Colorado Fuel and Iron Corp. Steel was produced for local plate and pipe mills. Annual capacity for the seven basic open-hearth furnaces was reported to be 506,500 short tons.

The American Manganese Steel Division of American Brake Shoe & Foundry Co. produced manganese steel castings and chrome molybdenum steel castings at its New Castle plant.

Iron and steel scrap was generated in Wilmington, Dover, and Smyrna. Shipments from yards consisted of Nos. 1 and 2 Heavy Melting steel, cast-iron scrap other than borings, No. 1 electric furnace bundles, stainless steel, and unprepared scrap.

Pyrites Co., Inc., produced sinter at Wilmington for making pig iron and steel. Raw materials for the sinter were residue from a pyrite concentrate produced in Pennsylvania, aniline sludge, and flue dust.

A smelter and refinery was operated by North American Smelting Co. Rotary, crucible, sweat, and reverbatory furnaces, also kettles, were used to produce bronze, brass, aluminum, and zinc casting alloys, solder, babbitts, and type metal. Primary metals consumed were aluminum, antimony, lead, tin, and zinc.

REVIEW BY COUNTIES

Kent.—Sand and gravel, principally for building and paving material, was produced near Dover, Milford, and Wyoming. Production increased about 21 percent over 1958, making Kent the second-ranking mineral-producing county. About 54 percent of the sand and gravel was washed or screened. St. Jones River Gravel Co. operated a stationary plant producing both washed and unprepared material. F. M. Carpenter produced bank-run gravel, while Clough & Caulk Sand & Gravel marketed washed and screened sand and gravel.

New Castle.—New Castle was the leading county in mineral production, and mineral output increased 3 percent over 1958. Output of sand and gravel by commercial and Government-and-contractor operators decreased 2 percent. The sand and gravel was produced primarily as paving and building material, and slightly more than half of the production was washed or screened. Washed sand and gravel was produced from stationary plants by Petrillo Bros., Inc., near Wilmington; Delaware Sand & Gravel Co., New Castle; and Whittington's Sand & Gravel Co., Bear. These companies also marketed unprepared material. Parkway Gravel, Inc., near Jefferson Farms and Hares Corner, used portable plants to produce bank-run gravel. The entire sand and gravel production was shipped to consumers by truck.

Granite continued to be produced by Petrillo Bros., Inc., from a quarry near Wilmington. The crushed rock was transported by truck from the crushing plant to each project.

Miscellaneous clay, produced at New Castle from an open pit, was crushed, ground, and screened for use by Delaware Brick Co. in producing building brick.

Sussex.—Output of commercial sand and gravel in Sussex County increased approximately 41 percent over 1958. Engine sand and paving gravel were the principal materials produced. Lewes Sand Co. and Henry G. Graves & Sons, Inc., operated portable plants near Lewes, which produced bank-run sand and washed paving sand, respectively. Atkins Bros., operating a stationary plant near Millsboro, produced washed sand and gravel and bank-run sand. The entire output of sand and gravel from this county was transported to consumers by truck.

Government-and-contractor production of sand and gravel for highway construction was reported from pits in Sussex County.

The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Florida.

By Lawrence E. Shirley [1] and Robert O. Vernon [2]

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MINERAL production in Florida set a new high in 1959 with a total value of $163 million, 14 percent more than in 1958 the previous record year. The mineral industry of the State experienced tremendous growth, not only in 1959 but in the last decade. Since 1952 the total value of mineral production more than doubled. Phosphate rock, the most valuable mineral commodity in the State, increased output 7 percent and value 3 percent over 1958, and 13 and 10 percent, respectively, over 1957. Large gains also were made during the year in output of masonry and portland cement, crushed stone, fuller's earth and miscellaneous clay, lime, sand and gravel, titanium and zirconium concentrates, rare-earth metal concentrates, and other commodities.

TABLE 1.—Mineral production in Florida [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	450	$5,808	[2] 245	[2] $6,171
Gem stones	----------	----------	(3)	3
Lime	(4)	(4)	111	1,238
Natural gas ... million cubic feet	35	5	[5] 34	[5] 6
Peat	36	165	34	158
Petroleum (crude) ... thousand 42-gallon barrels	449	(4)	[5] 424	(4)
Phosphate rock ... thousand long tons	10,851	68,951	11,564	71,208
Sand and gravel	5,490	[6] 4,389	6,674	5,177
Stone [7]	23,549	30,983	26,917	35,940
Titanium concentrates—gross weight	190	5,495	262	7,195
Zirconium concentrate	30	1,018	(4)	(4)
Value of items that cannot be disclosed: Cement, clays (kaolin and miscellaneous clays (1959), magnesium compounds (1959), rare-earth concentrates, staurolite, stone (dimension limestone), and values indicated by footnote [4]	----------	[6] 28,510	----------	40,034
Total Florida [8]	----------	[6] 142,114	----------	163,447

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain clays, value included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Preliminary figure.
[6] Revised figure.
[7] Excludes certain stone, value included with "Items that cannot be disclosed."
[8] Total has been adjusted to eliminate duplicating value of clay and stone.

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Florida led the Nation in phosphate rock output for the 66th consecutive year and in production of fuller's earth, monazite, and staurolite; Florida was second in the Nation in rare-earth metal concentrate output and third in peat production. Leading industries were mining and processing phosphate rock, manufacturing cement, and crushing limestone. Leading phosphate rock producers were International Minerals and Chemical Co.; Davison Chemical Co., Division of W. R. Grace Co.; and American Agricultural Chemical Co. Leading cement manufacturers were General Portland Cement Co. and Lehigh Portland Cement Co.; leading crushed stone producers were Florida Rock Products Co., Camp Concrete Co., and Brooksville Rock Co.

Employment and Injuries.—Reports submitted to the Federal Bureau of Mines by producers in the mineral industries throughout the State indicated that 4 percent less mines, quarries, and mills were active than in 1958, a decrease of seven operations. The number of men working daily in these industries increased 5 percent over 1958, and average active days worked increased 10 percent during the year. Total man-hours worked increased 2.2 million or 16 percent over 1958, reflecting primarily more men working daily and more average active days worked for all industries except metal mines, which showed no gain in active days worked.

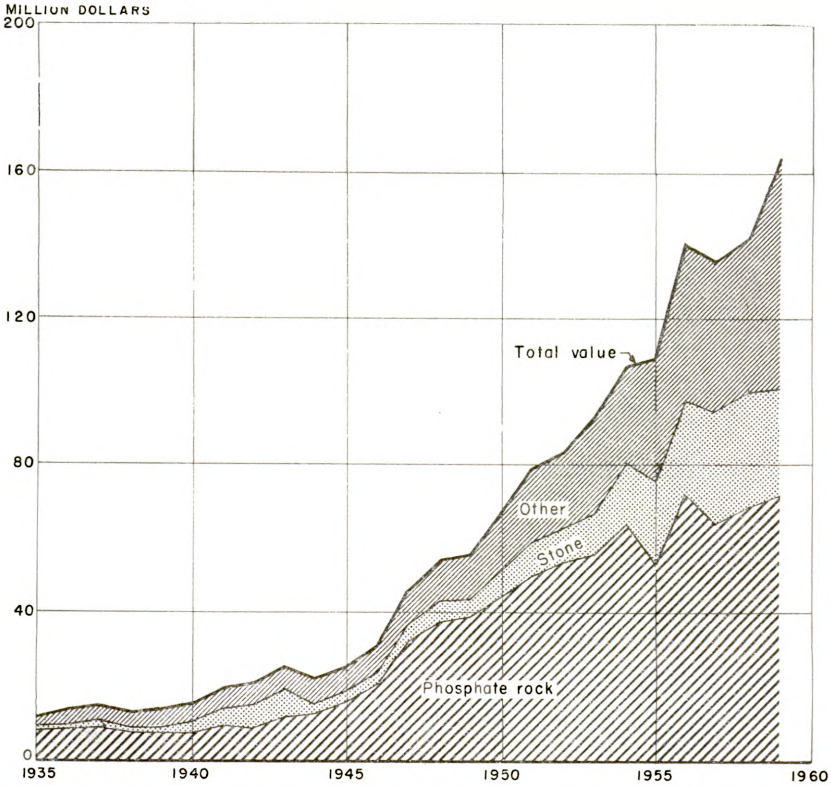

FIGURE 1.—Value of phosphate rock, stone, and total value of mineral production in Florida, 1935–59.

The overall injury frequency rate was 12 percent less than in 1958; injuries per million man-hours decreased by two. Nonfatal injuries increased by five during the year, showing an increase of 2 percent; six fatal accidents occurred in 1959 three more than in 1958.

Consumption, Trade, and Markets.—Foreign trade through major Florida seaports continued an increase begun in 1950, and had more than tripled—from $183 million in 1950 to $556 million in 1959. Exports from Florida ports were valued at $279 million, and imports were valued at $277 million. West Palm Beach, from which a railroad ferry operated to Cuba, handled imports and exports valued at $133 million—leading the State; the Tampa port, however, led in tonnage of imports and exports, totaling 4 million tons. The Florida Ports & Foreign Trade Council was organized during the year to coordinate the activities of the major State's seaports and to promote foreign trade. Objectives of the organization were to achieve uniformity in port practices and charges, work for improvement of port facilities, and design a rate-protection program to promote favorable freight rates for the State. The Council was operated by the ports and included those of Jacksonville, St. Augustine, Port Canaveral, Fort Pierce, West Palm Beach, Port Everglades, Miami, Boca Grande, Tampa, Port St. Joe, and Pensacola. General Development Corp. joined with the Fort Pierce Port and Terminal Co. to expand a deep water cargo port at Fort Pierce; the company planned to ship limestone rock, fertilizer, and other materials from the port after completion of the $1 million expansion.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1958							
Nonmetal mines	34	3,167	279	7,043,309	1	39	6
Quarries and mills	83	2,625	264	5,540,589	1	152	28
Metal mines	4	452	276	998,584	----------	6	6
Sand and gravel mines	36	389	271	841,851	1	24	30
Total	157	6,633	272	14,424,333	3	221	16
1959 [1]							
Nonmetal mines	35	3,305	291	7,700,358	3	60	8
Quarries and mills	78	2,773	314	6,975,935	3	143	21
Metal mines	4	481	276	1,061,625	----------	6	6
Sand and gravel mines	33	409	285	932,254	----------	17	18
Total	150	6,968	299	16,670,172	6	226	14

[1] Preliminary figures.

The Atlantic Coast Line Railroad instituted a new freight service in which transport trailers were carried piggyback in flatcars from Orlando, Tampa, St. Petersburg, Jacksonville, and Miami in conjunction with Florida East Coast Railway to New York, Baltimore, Philadelphia, Charleston, and Savannah. With this innovation, by agreement between truck haulage companies and railroads, two trailers were hauled on each flatcar.

Virginia-Carolina Chemical Co. joined with Tampa Electric Co. and Peabody Coal Co. to ship phosphate rock from Florida to the East Texas Coast and Mississippi River and to bring coal from Peabody mines in Kentucky and Illinois to the Tampa Electric Co. Gannon steam plant. Two new shipping firms were formed—Gulf Transit Co. and Mid-South Towing Co. These new shipping firms will not displace rail haulage of coal where Tampa Electric Co. also has a two-way haul arrangement involving phosphate products and coal. Florida led the Nation in output of phosphate rock but imported its coal from other States. An estimated 25 percent of phosphate rock production was exported, and its products—fertilizer and others—were shipped to all parts of the United States.

Sand and gravel and crushed stone, important mineral commodities in the State, were used increasingly in new roadbuilding and bridge construction. An accelerated Interstate Highway Construction Program and increased use of these materials in prestressed concrete for consumption in the State contributed much to the local economy, establishing many new markets during the year.

Florida's rapid growth in cement output was due to State industrial expansion; much of the cement manufactured was used locally, and a considerable quantity was shipped to nearby States. Gypsum, perlite, and vermiculite, in which the State is deficient, were brought in from other States and processed for consumption in Florida and nearby States.

Fuller's earth, of which Florida led the Nation in output, was mined and processed within the State and shipped to other States. Lime was produced by two companies and used in their own plant operations for water purification and paper manufacture, respectively. Titanium and zirconium concentrates were mined and processed in the State; titanium concentrate was shipped out of State for use by the pigment and welding-rod-coating industries; zirconium concentrate was consumed in the State (manufacturing zirconium metal) and shipped out of State.

Trends and Developments.—Florida's industrial growth and large population increase in 1959 contributed most to new developments during the year. Florida led the Southern States with a total of 8,656 new ventures started, compared with 133,891 for the Nation, and ranked third in the United States (exceeded only by New York and California). Florida gained over 246,000 persons in 1959, giving it the largest population in the Southeast. Since 1950 the State has experienced a 72-percent gain in population, 2.77 to 4.76 million, the largest percentage gain for any State except Nevada. The State ranked second in the Nation in terms of value of shipments of nonmetallic minerals (exceeded only by California), continuing a trend begun several years before.

Demand for electricity in Florida increased rapidly due to fast industrial growth. The bulk of Florida power was obtained from fuel oil; the advent of natural gas in 1958 and continued use of coal in some plants reduced some costs by creating competition among fuel suppliers. Florida's four major power companies and some of the municipality owned plants had expansion programs underway.

Tampa Electric Co. and Florida Power Co. purchased a 700-acre tract of land east of Tampa and St. Petersburg for a proposed 50,000 kilowatt nuclear powerplant—operation expected in 1963. The project was to cost $23 million and construction would be subject to regulatory authorization including that of AEC.

Florida Power & Light Co. announced a $485 million construction program that would extend through 1964 and increase the company generating capacity from 1.65 to 2.7 million kilowatts. New generating facilities under contract were two 240,000-kw. units at Port Everglades and two 300,000-kw. units at Riviera Beach. Gulf Power Co. completed a fourth generating unit at its Crist steamplant, doubling plant capacity, and began engineering work for a fifth unit, which would triple capacity to 225,000-kw. in 1961. Lakeland Light & Water Co. made a 25,000-kw. addition to its Lake Parker plant, and Orlando Utilities Commission added 18,000-kw. capacity to its Ivanhoe plant during the year. The Houston Corporation, Florida's major natural gas supplier, applied for permission to increase initial capacity of 282 million cu. ft. to 417 million cu. ft. in 1960. Outlook for continued industrial growth prompted the swift expansion.

Roadbuilding and bridge construction set new records in the State during the year. Contracts for 332 road projects totaling $133 million were let, and an even greater program was indicated for 1960. The Florida Development Commission's bond-revenue department sold revenue bond issues totaling $37.6 million for road construction in 10 counties. The Commission also received requests and authorized financing for 10 projects in 10 other counties totaling $41.2 million. The Interstate Highway Construction Program in Florida consisted of 1,142 miles of proposed roads, the largest allocation in the Southeast. Fifty-four miles of this allocation, including a 39.8 mile section of the Sunshine State Parkway, had been completed, 150 miles was under construction, and 410 miles was in various stages of operation, including the 250 miles for which plans and surveys were underway. All work on Interstate Route 95 and 40 miles of Interstate 10 west from Jackson was let to contract. Much early interstate construction was in urban areas. During 1959, two road projects serving defense installations at Cape Canaveral and Patrick Air Force Base (financed by the Department of Defense) were being studied or in various stages of construction by the Federal Bureau of Public Roads. The Bureau of Public Roads also continued a cooperative research program with the University of Florida on bridge design, employing prestressed concrete. The trend to greater consumption of crushed limestone, sand and gravel, and other road and bridge construction materials was expected to continue.

Air Products, Inc., of Allentown, Pa., constructed a liquid hydrogen facility near West Palm Beach to provide the U.S. Air Force with high-energy fuel for missile development; the hydrogen production section of the plant used Florida crude oil, oxygen, and water to generate hydrogen gas; nitrogen was used for precooling the hydrogen. Estimates of output ranged from 3.5 to 10 million pounds per year of liquid hydrogen, and the plant was reported to be the largest in the world.

Pan-American Sulfur Co. completed its new liquid-sulfur-loading facility at Tampa to supply low-ash, zero-moisture sulfur to Florida west-coast fertilizer producers. Pan-American also began constructing a dry-bulk facility that would enable the company to maintain an inventory of 50,000 tons of sulfur. Texas Gulf Sulfur Co. and Debardelebin Marine Corp. jointly announced establishment of a liquid-sulfur terminal and storage facility at Tampa. A specially designed company ship hauled sulfur from Texas to Florida and also carried ammonium sulfate, potash, salt cake, ore, phosphate rock, superphosphate, triple superphosphate and other dry-bulk commodities between ports.

In the phosphate-rock industry, labor disputes hindered operations for a small part of the year, but mining increased in the latter part of the year. Most of the producing companies signed new 3-year contracts with the labor unions, indicating a projected period of tranquility in labor relations. Two major phosphate companies completed major reorganizations and expansion in the phosphate fertilizer industry was at a record high. The Tennessee Valley Authority (TVA) purchased acreage in the hard-rock phosphate fields, bringing its holdings to 3,470 acres and began operating a demonstration-scale plant to produce fertilizers from Florida leached-zone phosphate.

Legislation and Government Programs.—The Federal Bureau of Mines announced a program to search for bloating clays and shales in several States, including Florida (to establish adequate reserve supplies of lightweight aggregate) and continued research on beneficiating kaolin to increase recovery and improve its properties. The Bureau, at its Norris (Tenn.) Metallurgy Research Laboratory, conducted tests on 30 samples of various clays from the State during the year. The Bureau also continued investigations to determine the chemical and physical nature of Florida phosphate slimes at its Tuscaloosa Metallurgy Research Center, University, Ala.

The 1959 regular session of the Florida Legislature passed three laws of statewide significance concerning the mineral industry:

> Chapter 59–178 (H.B. 590)—Public Lands. Permits all State agencies having title to any lands or having control of lands owned by the State to sell or lease any minerals, phosphate, earth, clay, sand, gravel, shell, metal, timber, or water in, on, or under such lands other than hard-surfaced beaches and lands contiguous thereto out to the mean-low-water depth of 3 feet and landward to the nearest paved public road.
>
> Chapter 59–375 (H.B. 1603)—Mineral Rights. Unless otherwise specified the word "minerals" when used in any deed, lease, or other written contract does not include topsoil, muck, peat, humus, sand, and common clay.
>
> Chapter 59–220 (S.B. 635) amended Section 270.11, F.S., to permit the Trustees of the Internal Improvement Fund and the State Board of Education to sell or release their reserved interest in phosphate, minerals, metals, and petroleum found on lands previously sold, regardless of the size of the parcel, if a building is on, or proposed to be constructed on, the property. Before July 1, 1959, such interest could be sold or released for only 1 acre.

The Florida State Board of Health and Air Pollution Control Commission worked with industry during the year on pollution problems confronting the mineral-processing industries. Many of the phosphate producers carried on research programs, individually or jointly, in an effort to clear up pollution problems confronting the industry.

Florida signed a cooperative agreement with the U.S. Department of the Interior, authorized by the Saline Water Act of 1952, providing for general assistance and exchange of information between individual States and the Office of Saline Water on development of improved saline-water-conversion processes and their actual potential application. Florida is one of the five States that signed saline water agreements with the Department of Interior. The Department also completed an experimental deep-basin solar still for converting sea water at a site near Port Orange; the unit was operated by Batelle Memorial Institute and was one of three shallow-basin stills at the site; two were nearing completion. Other sites in Florida also were under consideration for similar studies.

The U.S. Department of the Interior received leasing offers from at least two major oil companies on Florida off-shore areas for exploration for oil and gas; bids were made on 23 tracts totaling 132,480 acres valued at $1.7 million. Sale was made by the Federal Bureau of Land Management, and the leases were supervised by the Federal Geological Survey.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement manufacture continued its upward climb and set a new high. Total production of all types of cement increased 32 percent in quantity and 34 percent in value. Portland cement increased 33 percent in quantity and 37 percent in value and masonry cement 19 and 18 percent, respectively.

Lehigh Portland Cement Co. operated plants near Bunnell (Flagler County) and near Miami (Broward County). Lehigh manufactured six types of portland cement: Normal, moderate heat, high early strength, low heat, sulfate-resisting, and air-entraining. The company also manufactured mortar cement. The Bunnell plant had an annual clinker capacity of 3.35 million barrels [3] and was equipped to use alumina clay shipped from the company deposit near Warm Springs, Ga. This eliminated the need to purchase argillaceous material at Bunnell to make a properly proportioned raw mix. At the Bunnell plant, overhead silos were constructed to provide additional storage and adequate facilities for loading bulk cement directly into trucks at greatly accelerated speeds. Lehigh's Miami plant, completed in 1958 at a cost of $25 million, used a two-kiln wet process for manufacturing cement; its annual clinker capacity is 2.5 million barrels.

General Portland Cement Co. operated its Tampa and Miami plants throughout the year. The Miami plant, which began producing cement mid-1958, had an annual capacity of 2.5 million barrels and was designed for a two-kiln wet-process operation. The company announced a 3-million-barrel expansion program for the Tampa plant, which had a capacity of 4 million barrels. The program cost estimate was $17 million and would double the plant's white-cement capacity. Articles concerning Florida cement plants were published in trade journals.[4] During the year General Portland Cement Co. merged with Consolidated Cement Co., making the new firm the fifth largest in annual capacity among U.S. companies, with capacity of 25 million barrels.

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[3] Lehigh Portland Cement Co., (Allentown, Pa.), Report for the year ended Dec. 31, 1959.

Rapid growth in cement production was due to Florida's industrial expansion, which included building, road, and bridge construction. Prestressed concrete for bridges and other uses accounted for much of the growth. Concrete prestressed units were used in nearly every kind of structure.

Clays.—Total clay production, including fuller's earth, kaolin, and miscellaneous clay, increased 30 percent in tonnage and 19 percent in value. For the second consecutive year Florida ranked first in the Nation in production of fuller's earth, and output reached a new high. Tonnage and value increased 17 and 20 percent, respectively. Miscellaneous clay production also set a new record, increasing 45 percent in quantity and 44 percent in value. Miscellaneous clay used in cement increased 26 percent in tonnage and 24 percent in value, also establishing a new record. Kaolin output and value increased slightly over 1958. Fuller's earth was mined in Gadsden County by Minerals & Chemical Corp. (La Camelia mine), Floridin Co., Inc. (Quincy mine), and Magnet Cove Barium Corp. (Havana mine). The Floridin Co. Inc. was acquired during the year by Pennsylvania Glass Sand Corp. of Lewistown, Pa. Miscellaneous clay was mined by General Portland Cement Co., Citrus County, for use in manufacturing cement; by the Florida Solite Corp. (Russell mine), Clay County, for use in lightweight aggregate; and by the Appalachee Correctional Institute (Chattahoochee mine), Gadsden County, for use in making building brick. Kaolin was produced by United Clay Mines Corp. No. 4 mine, Putnam County.

The Florida Solite Corp., a wholly owned subsidiary of the Southern Lightweight Aggregates Corp. of Richmond, Va., reported miscellaneous clay production for the first year. The Corporation completed its new lightweight-aggregate plant and began producing aggregate for use in lightweight structural concrete and masonry units. The finished material was shipped by rail throughout the State and to surrounding areas.

Pozzolith, Inc., West Palm Beach, announced plans for a $650,000 plant to produce lightweight aggregate and a concrete additive. The Universal Sewer Pipe Corp., Leesburg, announced plans to build a $2 million pipe plant.

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[4] Meschler, Elwood, Coral Rock Serves As Base and Basis for New Cement Plant: Rock Products, vol. 62, No. 4, April 1959, pp. 82–85.

Trauffer, Walter E., General's Miami Plant Built Entirely of Concrete: Pit and Quarry, vol. 52, No. 1, July 1959, pp. 130–143.

Meschler, Elwood, General Portland Moves Into Miami Market: Rock Products, vol. 62, No. 11, November 1959, pp. 88–91.

Trauffer, Walter E., Lehigh's New Miami Plant: Pit and Quarry, vol. 52, No. 6, December 1959, pp. 76–86.

Gem Stones.—Gem stones, valued at $3,000, came from eight producers in four counties and consisted principally of agatized coral, quartz crystals, selenite, and shells. Most of the material came from the Tampa area. Lee County was the largest producing county, then Dade, Hillsborough, and Pinellas. This is the first year that substantial production has been recorded from the State.

Gypsum.—Imported crude gypsum was calcined and used in manufacturing building products by the United States Gypsum Co. at Jacksonville, Duval County. Heavier Southeastern demand for wallboard, plaster base, and gypsum sheathing required the company to expand its capacity by 25 percent during the year.

Kaiser Gypsum Co., of Oakland, Calif., acquired a property option on 34 acres on the east side of Dames Point for the construction of a plant. Primary engineering for the plant was underway, but the capacity was not disclosed. The plant will be adjacent to deep water transportation and will be supplied with self-discharging vessels. Estimated cost was $3 million.

Lime.—Lime was produced in four counties by four companies. Tonnage and value increased 186 percent and 155 percent, respectively. The City of Miami (Hialeah limekiln), Dade County, produced 22,000 tons of lime, valued at $230,000, used for municipal water purification and softening. Dixie Lime Products (Ocala No. 1 limekiln), Marion County, produced quick- and hydrated limes for masonry and chemical uses; tonnage decreased 11 percent, and other value increased 6 percent. Two new producers, both captive, reported for the first time. Buckeye Cellulose Corp. (Foley limekiln), Taylor County, produced quicklime for industrial water purification and recausticizing. Michigan Chemical Corp. (Port St. Joe limekiln), Gulf County, produced quicklime for use in paper and chemical and industrial uses.

Buckeye Cellulose Corp., Foley, extracted lime from ground water for use in its own operation.[5] The lime-recovery equipment provided soft water and at the same time eliminated a lime-sludge-disposal problem. Water used at the plant (40 million gallons per day) was taken from deep wells. It had a hardness of 200 p.p.m., which was reduced to 80 p.p.m. by the plant cold-lime softeners. About 100 tons per day of calcium carbonate sludge was obtained from which 50 tons per day of lime was produced. Removal of magnesium compounds from the sludge caused trouble at the start of the operation, but the problem was solved by carbonation followed by centrifugal classifying and dewatering. This process provided a 60-percent-solids cake largely free of magnesium. Considerable savings were effected by the company in supplying its own lime.

Magnesia.—Michigan Chemical Corp. reported initial production from its sea-water magnesia plant near Port St. Joe at yearend, augmenting its Michigan magnesia operation. The plant had a capacity of 125 tons per day and produced high-purity chemical and refractory magnesia for manufacturing basic brick and other refractory products, rubber, paper, textiles, insulation, ceramics, catalysts, and chemical processing. During the year the company announced an expansion program of the Port St. Joe operation to double capacity.

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[5] Rock Products, vol. 62, No. 8, August 1959, p. 32.

Perlite.—Three companies in three counties processed crude perlite from Western States. Airlite Processing Corp. of Florida, Indian River County, produced material for use in plaster and loose-fill insulation; Perlite, Inc., Dade County, processed material for use in building plaster and tile, concrete aggregate, loose fill insulation and soil conditioning; and Tennessee Products & Chemical Corp., Duval County, expanded perlite for use in building plaster. Total production from the three operations increased 45 percent in tonnage and 48 percent in value over 1958.

Phosphate Rock.—Florida was the leading State in the Nation in total phosphate rock production for the 66th consecutive year. The record high was set in 1956 when 11.8 million tons were mined, valued at $74.2 million. In 1959, production approached the record as 11.5 million tons valued at $71.2 million was mined. Total phosphate-rock production of all types increased 7 percent in quantity and 3 percent in value over 1958. Land pebble output increased 7 percent in quantity and 3 percent in value. Hard rock output decreased both in tonnage and value, and soft rock decreased 3 percent in tonnage while the value remained virtually unchanged. Land-pebble phosphate comprised more than 98 percent of total production, as in 1958. Output came from 14 mines operated by 8 companies in Polk and Hillsborough Counties. In Hillsborough County, American Cyanamid Co. operated the Sydney mine and American Agricultural Chemical Co. operated the Boyette mine. These were the only two land-pebble operations in the county. In Polk County the following companies operated land pebble mines: American Agricultural Chemical Co. (South Pierce mine); American Cyanamid Co. (Orange Park mine); Armour Fertilizer Works (Armour mine); Smith-Douglass Co. Inc. (Tenoroc mine); Davison Chemical Co., Division of W. R. Grace Co. (Bonny Lake and Pauway No. 4 mines); International Minerals & Chemical Co. (Achan and Noralyn mines); Swift & Co. (Varn and Watson mines); and Virginia-Carolina Chemical Corp. (Clear Springs and Homine mines). Most of the land-pebble production was used in manufacturing ordinary and triple superphosphate, in direct application to soil, in stock and poultry feed, manufacturing phosphorous, phosphoric acid and ferrophosphorous, and in wet-processing phosphoric acid. Substantial quantities of land-pebble phosphate were exported.

Kibler-Camp Phosphate Enterprises (Section 20 mine), Citrus County, was again the only hard-rock phosphate producer in the State. The material was used in manufacturing phosphorus and ordinary superphosphate.

Soft-rock phosphate production remained virtually the same as in 1958. Output came from seven producers in four counties: Camp Phosphate Co. (Hernando mine), Kellogg Co. (Kellogg mine), Soil Builders, Inc. (Mincoll mine), and Sun Phosphate Co. (Dunnellon mine), Citrus County; The Loncala Phosphate Co. (Fort White mine), Columbia County; (Mona mine), Gilchrist County; and Superior Phosphate Co. (Superior mine), Marion County.

The three largest land-pebble producers were International Minerals & Chemical Co., Davison Chemical Co. Division of W. R. Grace Co., and American Agricultural Chemical Co. The three largest producers of soft rock in order of output were Kellogg Company, Soil Builders, Inc., and Superior Phosphate Co.

The phosphate-rock industry made tremendous strides during the last decade, partly because of mounting demand for high-analysis phosphate-type fertilizers. The phosphate industry in Florida was estimated to employ more than 5,000 persons, who received more than $25 million a year in salaries. The industry paid taxes to the counties amounting to $2.25 million, contributed $10 million per year to railroads for transportation directly and double that amount indirectly, and paid $9 million annually for electricity, $8.5 million for industrial equipment, and $2.25 million for electrical equipment and supplies.

American Cyanamid Co., Orange Park, built a new phosphate washer employing flotation of coarse feed. The new washer was similar to one at another company plant, and the two installations were said to be the only ones using that method. The company Brewster plant, which included the Sydney and Orange Park mines, gained the world record for open-pit mining without a lost-time accident from June 24, 1957, to October 30, 1959; 3.8 million man-hours were worked—nearly 2 million man-hours more than the previous record. Sydney mine operated more than 5½ years and Orange Park mine over 2 years without a disabling injury.

Armour Agricultural Chemical Co. set up two major divisions—Fertilizer and Nitrogen-Phosphate—in a major realinement of the company. The Nitrogen-Phosphate Division took over the Florida phosphate mining and processing facilities at Bartow, and the company's 27 fertilizer-producing operations in the United States were grouped in the fertilizer division. Formal action by the Bartow City Commissioners cleared the way for Armour to mine phosphate rock within city limits. The area was rezoned as M–1 for mining, and two changes were made in the ordnances governing mining within city limits; the time limit was extended from 3 to 5 years, and the regulation demanding that the reclaimed land be able to withstand a pressure of 3,000 pounds was amended to read 1,700 pounds, which met FHA housing specifications.

Smith-Douglass Co. discontinued the Coronet phosphate division and in the future was to use the corporate name for identification in all its operations. The company also merged during the year with Smith Agricultural Chemical Co. At its Plant City plant, the company added a new scrubbing unit, which recovered 97 to 99 percent of impurities, mostly fluorine. Including addition of the scrubber, company expenditures for research and equipment to recover fluorine from Florida phosphate rock and make it into a salable product were about $750,000.

Davison Chemical Co. Division of W. R. Grace Co., awarded a contract for construction of a Monsanto contact sulfuric acid plant at Bartow. The plant was to have an initial rated capacity of 400 tons per day. Facilities were to be provided for additional expansion as required. Elemental sulfur was to be the raw material.

Early in 1959 the company began building a $500,000 addition to its fertilizer plant at Ft. Pierce to produce granulated fertilizers; existing equipment produced conventional ground fertilizers.

International Minerals & Chemical Corp., in a major reorganization, placed the Florida phosphate and chemical operations of the company in a new Agricultural Chemicals Division. The new division combined the former phosphate and potash divisions. During the year, the company enlarged the Bonnie phosphate chemical plant in a major plant-expansion program costing $2.8 million. A 3-year labor contract with the International Chemical Workers was signed for Bonnie plant. During the previous 3½ years the company spent $2 million to reduce air pollution at its Florida plants, and during the year continued a $1.4 million program aimed at new improvements. It was estimated that $7 million had been spent on modern waste-control equipment in the Polk-Hillsborough phosphate areas up to 1959. International joined with six other companies in an industry research program on air pollution.

Virginia-Carolina Chemical Corp. at Bartow announced plans for building a $5 million triple superphosphate plant at Nichols, which would double production capacity. New features of the plant were provisions for better cleaning, elimination of air pollution, and improved working conditions. A strike involving 600 employees and lasting 10 weeks hindered operations during June and July. The dispute resulted from a proposal by the company to divide mining and refining operations into two contract units. Negotiations were still underway at yearend; employees returned to work after 10 weeks. The company started a land-reclamation program on worked-out phosphate mining land south of Bartow, leveling it and planting orange trees experimentally.

Victor Chemical Works became Victor Chemical Division of Stauffer Chemical Co. Victor owned phosphate-rock reserves in Florida and an elemental phosphorus plant.

TVA [6] purchased an additional 615 acres as a result of prospecting in the Florida hard-rock phosphate fields, increasing total holdings to about 3,470 acres—an estimated 16.5 years' supply of high-grade phosphate rock at the 1959 rate of consumption. TVA was prospecting and purchasing land in the Florida hard-rock fields to assure an adequate supply of high-grade phosphate rock for future experimental operations and national defense. TVA placed in operation during the year a demonstration-scale plant designed to produce fertilizers from Florida leached-zone phosphate, a low-grade phosphate ore discarded with the overburden in phosphate strip-mining operations. The plant used a TVA-developed fertilizer process, on which work was begun in 1952 in conjunction with a joint project with AEC for recovering uranium contained in the leached-zone ore. Further small pilot-plant operations were undertaken to develop methods of beneficiating Florida hard-rock phosphates. In Florida mining operations the slime part of hard-rock phosphate was discarded. The pilot-plant operation followed small-scale studies made in 1958 in which about 75 percent of the phosphate was recovered in a concentrate containing 31 to 32 percent P_2O_5. Kentucky Store & Land Co. purchased 2,700 acres of phosphate land in the Bone Valley District between Bartow and Ft. Meade at a cost of $8.5 million.

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[6] Tennessee Valley Authority, Annual Report of the Tennessee Valley Authority, for Fiscal Year Ended June 30, 1959, 89 pp.

U.S. Phosphoric Products, a division of the Tennessee Corporation, Tampa, completed and placed in operation a new diammonium phosphate plant. The company also employed its own solvent-extraction process to produce a substantial tonnage of uranium tetrafluoride byproduct at this plant.

Several articles were written on phosphate-rock mining and processing in the State.[7]

TABLE 3.—Marketable production of phosphate rock

(Thousand long tons and thousand dollars)

	Hard rock		Soft rock		Land pebble		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	77	$597	85	$485	8,994	$53,338	9,156	$54,420
1955	91	734	70	452	8,586	52,454	8,747	53,640
1956	96	809	59	378	11,668	73,103	11,823	74,290
1957	80	689	51	365	10,059	63,736	10,191	64,789
1958	87	737	53	414	10,711	67,800	10,851	68,951
1959	78	666	52	414	11,434	70,128	11,564	71,208

TABLE 4.—Phosphate rock sold or used by producers, by uses

Use	1958			1959		
	Long tons	Value	Average unit value	Long tons	Value	Average unit value
Ordinary superphosphate	4,420,998	$28,527,147	$6.45	4,293,954	$26,891,017	$6.26
Phosphoric acid (wet process)	979,816	5,575,153	5.69	(1)	(1)	(1)
Triple superphosphate	1,300,879	8,377,661	6.44	[2] 3,459,413	[2] 20,220,090	5.84
Direct application to the soil	(3)	(3)	(3)	598,227	3,778,731	6.32
Stock and poultry feed	(3)	(3)	(3)	350,977	2,254,136	6.42
Elemental phosphorus, ferrophosphorus, phosphoric acid	593,478	3,544,784	5.97	341,193	2,017,055	5.91
Other uses [4]	976,710	6,362,827	6.51	50,884	320,061	6.29
Exports	2,301,087	14,965,389	6.50	2,665,562	17,382,120	6.52
Total	10,572,968	67,352,961	6.37	11,760,210	72,863,210	6.20

[1] Included with triple superphosphate.
[2] Includes phosphoric acid (wet process).
[3] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[4] Includes nitraphosphate and other fertilizers.

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[7] Becker, J. N., Coronet Wrests Phosphate from Swamps: Excavating Eng., vol. 53, No. 11, November 1959, pp. 25–29.
Lenhart, Walter B., Stripping, Sluicing and Pumping Phosphate: Rock Products, vol. 62, No. 1, January 1959, pp. 122–123, 142.
Nardi, Julian, Pumping Solids Through a Pipeline: Chem. Eng., vol. 66, No. 15, July 27, 1959, pp. 119–122.
Roberts, A. E., Cyanamid Floats Coarse Phosphate: Min. World, vol. 21, No. 2, February 1959, pp. 32–36.
Trauffer, Walter E., Florida's Features—Newest Phosphate Washer, Flotation of Coarse Feed—Air Agitation in Flotation: Pit and Quarry, vol. 52, No. 4, October 1959, pp. 86–93.

Sand and Gravel.—Florida established a new high in production of sand and gravel. Total output sold or used by producers was 6.7 million tons valued at $5.2 million, an increase of 22 percent in tonnage and 18 percent in value over 1958. Individually, sand production increased 22 percent in tonnage and 18 percent in value; gravel increased 22 and 15 percent. Sand and gravel came from 33 mines operated by 32 companies in 12 counties. Leading counties in the State in order of output were Polk, Putnam, and Lake. Leading producers of sand were Mammoth Sand Co. (Lake Wales mine), Pembroke; and Standard Sand & Silica Co. (Standard mine), and Oak Ridge Sand Co. (Achan mine), Mulberry. All three companies produce building and paving sand and are in Polk County.

Thatcher Glass Manufacturing Co., Tampa, began constructing a $3.5 million glass-container plant. The plant, expected to be completed in early 1960, occupied a 30-acre site and was to employ approximately 250 persons.

Florida Silica Sand Co. opened a new bagged-materials warehouse and bulk-graded aggregate yards in Miami; blasting sands, graded aggregates, and filter media were among the products made available from the new yards.

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Bay	104,733	$84,468	(1)	(1)
Broward	12,102	8,695	41,225	$25,900
Dade	(1)	(1)	(1)	(1)
Escambia	356,716	303,351	476,405	406,239
Gadsden	(1)	(1)	229,436	382,890
Indian River	7,695	4,700	-----	-----
Lafayette	24,786	20,307	-----	-----
Lake	(1)	(1)	793,579	573,157
Leon	(1)	(1)	56,588	75,850
Pinellas	85,479	127,502	71,316	99,407
Polk	2,766,395	2,035,190	3,320,219	2,351,224
Putnam	1,082,884	844,527	1,236,084	1,006,177
St. Lucie	-----	-----	(1)	(1)
Volusia	(1)	(1)	(1)	(1)
Undistributed	1,048,963	959,812	449,196	256,114
Total	5,489,753	4,388,552	6,674,048	5,176,958

(1) Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Averago per ton
Sand:						
Structural	4,075,483	$3,094,847	$0.76	5,299,862	$3,938,056	$0.74
Paving	676,452	519,506	.77	371,132	240,841	.65
Fill	----------	----------	----------	201,872	110,876	.55
Filter	9,404	11,014	1.17	(1)	(1)	(1)
Other[2]	334,329	213,345	.64	(1)	(1)	(1)
Total	5,095,668	3,838,712	.75	(1)	(1)	(1)
Gravel:						
Structural	185,530	194,359	1.05	(1)	(1)	(1)
Paving	201,219	348,931	1.73	194,951	348,172	1.78
Other	7,336	6,550	.89	(1)	(1)	(1)
Total	394,085	549,840	1.40	(1)	(1)	(1)
Total sand and gravel	5,489,753	4,388,552	.80	6,674,048	5,176,958	.78

[1] Figure withheld to avoid disclosing individual company confidential data; included in "Total sand and gravel."

[2] Includes glass, blast furnace, and other sands.

Staurolite.—Staurolite production increased 49 percent in tonnage and 46 percent in value over 1958, setting a new record for the State. E. I. du Pont de Nemours & Co., Inc., the only producer, recovered the material as one of the byproducts in concentrating titanium minerals at its Highland and Trail Ridge operations. Staurolite was used as an aluminum and iron additive in cement manufacture. Florida was the only State in the Nation reporting staurolite production.

Stone.—Total stone production again set a new high for the State. Output increased 14 percent in quantity and 16 percent in value over 1958. Record production was due to an accelerated highway-construction program, use of prestressed concrete, and industrial expansion. Crushed limestone production also established a record high; output increased 12 percent in quantity and 14 percent in value over the previous record set in 1958. Oystershell production, continuing its climb as an important source of material for construction and as poultry grit, established a new record for the year; tonnage increased 67 percent and value 38 percent. Dimension limestone decreased 90 percent in tonnage and 47 percent in value from 1958.

Crushed limestone was produced by 52 companies at 62 operations in 18 counties. Leading producing counties were Dade, Broward, and Hernando; the three leading producers, all in Hernando County, were Florida Rock Products Co., Camp Concrete Co., and Brooksville Rock Co. Other important producers were Maule Industries, Inc., Broward and Dade Counties, General Portland Cement Co., Citrus County, and Ideal Crushed Stone Co., Dade County. Commercial material was transported as follows: 67 percent by truck, 30 percent by railroad, and 3 percent by waterway. All noncommercial limestone was hauled by truck.

Crushed oystershell production during the year totaled 1.9 million tons valued at $2.8 million. The material, used principally in concrete, roadstone, and screenings, was produced by seven companies at eight operations in six counties. Pinellas County led in output. The three largest producers were Benton & Co., Pinellas County; Bay Dredging and Construction Co., Hillsborough County; and Bay Towing & Dredging Co., Walton County. Sixty-two percent of the material was transported by waterway, 36 percent by truck, and 2 percent by railroad.

Dimension limestone was quarried by one company (Keystone Art Co., Monroe County), compared with four companies in 1958.

Noncommercial limestone was produced by the Palm Beach County Highway Department in Palm Beach County—the only noncommercial producer in the State.

Shands & Baker, Inc., Jacksonville, leased 1,500 acres at Live Oak, from Live Oak Stone Co. The company planned to build a $1 million crushed-stone plant on the site and operate it under the name Florida Rock Products Co. Shands & Baker, Inc., also operated a plant at Brooksville. The new operation would produce from 350 to 400 tons of crushed stone per hour from limestone deposits near the plant site. Reserves were estimated to be sufficient for 20 to 25 years of operation. Transportation was to be by rail and truck.

Houdaille Industries, Inc., purchased the R. H. Wright & Son Co., a construction-materials business and crushed-limestone producer at Fort Lauderdale. The new operation was operated under the name R. H. Wright, Inc., and acquisition was part of an extensive expansion program by Houdaille Industries throughout Florida and the Southeast. The company also acquired all operating assets of Broward Asphalt Corp., Fort Lauderdale, which was operated as a division of R. H. Wright, Inc.

Southern Materials Co. Inc., Norfolk, Va., acquired the Jacksonville Concrete Co. and planned to operate it as a wholly owned subsidiary of Southern Materials. The firm operated four ready-mix concrete plants and one concrete-masonry block plant in the Jacksonville area.

The Polk County Fertilizer Co. leased the Red Level dolomite mine, north of Crystal River, Citrus County, which had been closed since 1942. Equipment was moved to the mine, and operations were expected to get underway mid-January 1960.

An article[8] on Camp Concrete Co. operation at Brooksville was published.

The Florida Engineering & Industrial Experiment Station published a study[9] on the properties of Florida asphalt-filler mixtures. The research work was on ground limerock, ground oystershell, ground silica dust, and blue-black slate flour.

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[8] Meschler, Elwood, Camp Zeroes In On Production Targets: Rock Products, vol. 62, No. 11, November 1959, pp. 117–119.

[9] Schweyer, H. E., and Tyner, M., Properties of Florida Asphalt-Filler Mixtures: Eng. Prog., Univ. of Florida, Bull. 103, vol. 13, No. 11, November 1959, 20 pp.

TABLE 7.—Crushed limestone sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Alachua	694,481	$676,999	860,580	$635,126
Broward	5,137,967	6,395,124	5,449,715	6,207,392
Citrus	(1)	(1)	(1)	(1)
Collier	442,252	423,638	453,593	607,164
Dade	7,422,265	9,360,795	6,969,203	9,104,744
Flagler	(1)	(1)	(1)	(1)
Hendry	(1)	(1)	(1)	(1)
Hernando	2,898,740	4,441,113	4,876,899	8,333,638
Jackson	(1)	(1)	----------	----------
Lafayette	59,000	59,000	203,000	182,700
Lee	(1)	(1)	(1)	(1)
Levy	1,019,004	1,156,346	611,520	825,939
Manatee	(1)	(1)	(1)	(1)
Marion	1,218,371	1,296,569	1,438,731	1,585,666
Monroe	293,750	260,000	126,500	242,000
Palm Beach	199,500	229,600	188,368	151,815
Pasco	(1)	(1)	(1)	(1)
St. Johns	(1)	(1)	----------	----------
Sarasota	(1)	(1)	----------	----------
Sumter	(1)	(1)	(1)	(1)
Suwannee	(1)	(1)	(1)	(1)
Undistributed	3,047,762	4,620,087	3,871,407	5,217,651
Total	22,433,092	28,919,271	25,049,516	33,093,835

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 8.—Crushed limestone and oystershell sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	19,806,047	$25,147,629	$1.27	22,698,773	$29,103,378	$1.28
Agstone	467,955	1,361,774	2.91	564,099	1,614,607	2.86
Stone sand	(1)	(1)	(1)	307,837	349,797	1.14
Poultry grit	47,915	580,980	12.13	(1)	(1)	(1)
Riprap	(1)	(1)	(1)	19,000	11,970	.63
Other [2]	3,227,576	3,892,564	1.21	3,327,397	4,860,061	1.46
Total	23,549,493	30,982,947	1.32	26,917,106	35,939,813	1.34

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes railroad ballast, asphalt filler, cement, lime, and other uses.

Vermiculite.—At plants near Tampa and Jacksonville Zonolite Co. exfoliated vermiculite from domestic crude ore received from out-of-State mines. The material principally supplied local markets but was also shipped out of State for consumption in plaster, concrete aggregate, loose-fill insulation, and other uses.

METALS

Aluminum.—American International Aluminum Company, Miami, manufacturer of aluminum extrusions, was formed early during the year by the merger of two companies, International Aluminum Co. and American Aluminum Extruders, both in business approximately 2½ years before the merger. The new company produced 2.5 to 3.0 million pounds of finished material each month, which is sold mainly to manufacturers and fabricators in the Florida area. In addition, increasing quantities were being exported to Latin America and the Orient. Aluminum pig and alloy ingredients were purchased from primary producers and melted and cast into billets suitable for extrusion. Major equipment items used were three 1,250- to 1,400-ton extrusion presses, one 1,250- to 1,500-ton press, and one smaller lightweight extruder press.

In the past few years a rapidly growing market developed in Florida for light-metal castings for aircraft and missiles. In 1959 missiles accounted for 33 percent of total military aircraft and missile expenditures, compared with 8 percent in 1955. Florida had six aircraft and missile manufacturing and test facilities, including Cape Canaveral.

Rare-Earth Metals.—Florida moved from the third to the second leading State in the Nation in production of rare-earth metals and ranked first in production of monazite. Titanium Alloy Manufacturing Division of National Lead Co. near Jacksonville, the only producer in the State, recovered monazite as a byproduct in concentrating titanium minerals.

Steel.—The Florida Steel Corp., Tampa, announced an expansion program involving construction of another small bar-rolling mill requiring a reheat furnace, two 3-mill-high stands with necessary operating equipment, and enlargement of its fabricating and maintenance facilities.

Titanium Concentrates.—Florida ranked second in the Nation for the fourth consecutive year in production of titanium concentrates. Total production of concentrates, both ilmenite and rutile, increased 38 percent in tonnage and 31 percent in value over 1958. Ilmenite production increased 35 percent in quantity and 19 percent in value; rutile shipments increased 440 percent in quantity and 454 percent in value over 1958.

E. I. du Pont de Nemours & Co., Inc., produced ilmenite from the Highland mine near Lawtey, Clay County, and from the Trail Ridge mine near Starke, Bradford County. The company began a $300,000 expansion program at the Trail Ridge operation, which would increase personnel requirements considerably.

Florida Minerals Co., Indian River County, produced both ilmenite and rutile for use in manufacturing pigments and welding rods. Rutile Mining Co. of Florida (Jacksonville mine) had no production of either rutile or ilmenite for the first time in many years although it made shipments from stocks on hand.

Titanium Alloy Manufacturing Division of National Lead Co., Duval County, mined both rutile and ilmenite at its Skinner mine near South Jacksonville.

Zircon.—Florida for the 20th consecutive year ranked first in the Nation in zircon production. Output and value increased over 1958; the unit price per ton increased 10 percent. E. I. du Pont de Nemours & Co., Inc., was the largest producer, recovering zircon from its Trail Ridge and Highland ilmenite operations. Titanium Alloy Manufacturing Division of National Lead Co., Duval County, and Florida Minerals Co., Indian River County, also produced zircon as a byproduct of rutile and ilmenite mining. The ore was shipped for use in refractory, ceramic, and welding products.

Columbia-National Corp., near Pensacola, continued to produce zirconium sponge, and supplied a hafnium-free product under contract to AEC. Beach-sand zircon was processed through successive stages of caustic fusion, filtration, nitration, solvent extraction, thermal decomposition, chlorination, and reduction of tetrachloride by the Kroll process to pure sponge.

MINERAL FUELS

Natural Gas.—Production of natural gas, all from Sunniland Field, Collier County, was virtually unchanged from 1958. The Houston Corporation, Florida's major natural gas supplier, completed its $150 million natural gas pipeline from Texas to Miami; plans were underway to increase capacity of the line nearly 50 percent, to 41.7 million cubic feet, in 1960. Mineral industries receiving direct allocations from the new system included several of phosphate-rock and fertilizer-producing companies, lightweight-aggregate plants, and a magnesia-producing company.

Peat.—Florida ranked third in the Nation in production of peat. Seven companies in four counties produced 34,000 tons valued at $158,000, a decrease of 5 percent in quantity and 4 percent in value from 1958. Hillsborough County was the largest producing county in the State, followed by Orange, Putnam, and Palm Beach Counties. Five companies produced humus peat and two companies reed-sedge; the material was used chiefly for soil improvement purposes.

Petroleum.—Crude petroleum production, all from Sunniland Field, Collier County, in the Everglades, was 424,000 barrels, a decrease of 6 percent from 1958. Cumulative production through 1958 totaled 6.1 million barrels. Florida had no new field discoveries during the year, although wildcat drilling activity increased from 7 wells in 1958 to 10 wells. Two of the wildcat wells were drilled offshore—one off the coast of Franklin County and one off the Florida Keys. Virtually every phase of exploration activity decreased from 1958. Seismic surveys, gravity-meter surveys, and core-drilling decreased from 22 to 25 percent or more from 1958. Most of the activity was in the peninsular area. Several large tracts were still under lease in the offshore areas, and although only dry holes had been drilled, additional exploration was anticipated offshore during 1960. The Federal government received leasing offers from at least two major oil companies in an area west of the Marquesas Keys. Gulf Oil Corp. and The California Co. bid jointly on 22 tracts, and The California Co. bid alone on one other. All 23 tracts totaled 132,480 acres, and bids totaled $1.7 million. Sale was made through U.S. Department of the Interior, Bureau of Land Management.

The Conservation Division of the Federal Geological Survey had 174 oil and gas leases under supervision in public, acquired, and Indian lands in Florida in 1958, totaling 295,674 acres; off Florida and in the Continental Shelf Area the division supervised 23 leases made to Gulf Oil Corp. and The California Co. jointly. Five acquired mining leases totaling 1,269 acres also were supervised.

Florida Oil & Refinery Co., a subsidiary of Frontier Refining Co., purchased a site near Jacksonville, Duval County, and began negotiating for domestic and foreign crude oil to supply a proposed refinery. The company was attempting to contract for 10,000 barrels (crude) per day—proposed plant capacity. Attempts also were made to get a Federal import quota for foreign oil. Plans were to produce regular and premium gasoline, butane, propane, kerosine, jet fuel, diesel fuel, gas oil, heating oil, and possibly asphalt. The capital investment, estimated at $10.5 million, would include the cost of deep-sea vessel and barge facilities.

Gulf Oil Corp., opened its Western Hemisphere extraterritorial marketing headquarters in Fort Lauderdale; the department, formerly in Pittsburgh, Pa., was moved because Florida is nearer Caribbean, Central, and South American areas, where Gulf has facilities to market a full line of its products.

REVIEW BY COUNTIES

Mineral production was recorded in 38 of 67 Florida counties, the same as in 1958. Polk, Dade, and Hillsborough were the leading counties furnishing 68 percent of the total mineral-production value; Polk County alone furnished 40 percent. Other important mineral producing counties, in order of value, were Flagler, Hernando, Clay, Gadsden, and Broward, each having a total value of more than $5 million. Limestone was produced in 18 counties, sand and gravel in 12, phosphate rock and oystershell in 6, and cement, heavy minerals and miscellaneous clay in 3. Of the leading eight counties, Dade and Hernando had the greatest increase in mineral-production value, 71 and 88 percent, respectively, over 1958.

Alachua.—Total value of mineral production decreased 6 percent from 1958. Williston Shell Rock Co. (Buda quarry), Parker Bros. (Haile quarry), Ocala Lime Rock Co. (Ocala Haile quarry), Newberry Corp. (Newberry Corp. quarry), and Peacock Lime Rock Co. (Peacock quarry) crushed limestone for use in concrete, as roadstone and screenings, and for agriculture. Most of the material was transported by railroad, and the remainder by truck.

TABLE 9.—Value of mineral production in Florida, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Alachua	$676,999	$635,126	Limestone.
Bay	84,468	(2)	Sand and gravel.
Broward	6,405,069	6,233,292	Limestone, sand and gravel.
Citrus	2,660,503	2,562,813	Limestone, phosphate rock, miscellaneous clay.
Clay	(2)	(2)	Ilmenite, zircon, staurolite, miscellaneous clay.
Collier	(2)	(2)	Petroleum, limestone, natural gas.
Columbia	(2)	(2)	Phosphate rock.
Dade	13,618,527	23,310,400	Cement, limestone, lime, sand and gravel, gem stones.
Duval	(2)	(2)	Rutile, ilmenite, oystershell, zircon, monazite.
Escambia	303,351	406,239	Sand and gravel.
Flagler	(2)	(2)	Cement, limestone.
Gadsden	(2)	(2)	Fuller's earth, sand and gravel, miscellaneous clay.
Gilchrist	(2)	(2)	Phosphate rock.
Gulf	-----	(2)	Magnesium compounds, lime.
Hendry	(2)	(2)	Limestone.
Hernando	4,441,113	8,333,638	Do.
Hillsborough	20,384,262	21,221,344	Cement, phosphate rock, oystershell, peat, gem stones.
Indian River	(2)	(2)	Rutile, ilmenite, zircon.
Jackson	(2)	-----	
Lafayette	79,307	182,700	Limestone.
Lake	(2)	573,157	Sand and gravel.
Lee	(2)	(2)	Limestone, oystershell, gem stones.
Leon	(2)	75,850	Sand and gravel.
Levy	1,156,346	825,939	Limestone.
Manatee	(2)	(2)	Limestone, oystershell.
Marion	(2)	(2)	Limestone, lime, phosphate rock.
Monroe	(2)	(2)	Limestone.
Orange	(2)	(2)	Peat.
Palm Beach	(2)	(2)	Limestone, peat.
Pasco	(2)	(2)	Limestone.
Pinellas	(2)	(2)	Oystershell, sand and gravel, gem stones.
Polk	63,401,780	65,755,924	Phosphate rock, sand and gravel.
Putnam	(2)	(2)	Sand and gravel, kaolin, peat.
St. Johns	(2)	-----	
St. Lucie	-----	(2)	Sand and gravel.
Sarasota	(2)	-----	
Sumter	(2)	(2)	Limestone.
Suwannee	(2)	(2)	Do.
Taylor	-----	763,400	Lime.
Volusia	(2)	(2)	Sand and gravel.
Walton	(2)	(2)	Oystershell.
Undistributed	[3] 29,006,251	32,567,178	
Total	[3] 142,114,000	163,447,000	

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[1] The following counties had no mineral production: Baker, Bradford, Brevard, Calhoun, Charlotte, De Soto, Dixie, Franklin, Glades, Hamilton, Hardee, Highlands, Holmes, Jefferson, Liberty, Madison, Martin, Nassau, Okaloosa, Okeechobee, Osceola, Santa Rosa, Seminole, Union, Wakulla, and Washington.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Revised figure.

Bay.—Cato Sand Co. (Mill Bayou mine) and Taylor Sand Co. (Taylor mine) produced building and paving sand; all sand was transported by truck.

Broward.—Broward County ranked eighth in the State in value of mineral production, 3 percent less than in 1958, and second in value of crushed limestone (for the second consecutive year). Thirteen companies crushed limestone at 14 quarries, one more than in 1958; new quarries reporting for the first year were C. T. Stockton, Inc., and Sample Rock Co., Inc. The three leading producers were Maule Industries, Inc. (Prospect quarry), Hollywood Quarries (Broward County quarry), and R. H. Wright, Inc. (Wright quarry). Houdaille Industries, Inc., purchased the R. H. Wright and Son Co., Fort

Lauderdale, as part of an expansion program and was to operate it in the future under the name R. H. Wright, Inc. Crushed limestone was used primarily for concrete, roadstone, and screenings and was transported primarily by truck; a small tonnage was transported by rail. Sample Rock Co., Inc. (Pompano mine), a new producer, mined unwashed sand for fill purposes.

Citrus.—Soft phosphate-rock output declined for the second consecutive year. Tonnage decreased 11 percent and value 13 percent from 1958. Producers, in order of output, were Kellogg Co. (Kellogg mine), Soil Builders, Inc. (Mincoll mine), Camp Phosphate Co. (Hernando mine), and Sun Phosphate Co. (Dunnellon mine). Production was used in agriculture, primarily by direct application to the soil, and also for stock and poultry feed.

Kibler Camp Phosphate Enterprise (Section 18 mine) was again the only hard-rock-phosphate producer in the State. Output was 78,000 tons valued at $666,000, a decrease of 10 percent in both tonnage and value from 1958. Hard-rock output was used mainly for manufacturing phosphorus and phosphoric acid by electric furnace.

General Portland Cement Co. mined miscellaneous clay (Tampa mine) and crushed limestone (Citrus County quarry) for use in manufacturing cement at its Tampa plant. Miscellaneous clay production set a new record for the year, and crushed limestone output increased slightly over 1958; these materials are the most valuable in the county.

Clay.—Clay county ranked sixth in the State in value of mineral production. E. I. du Pont de Nemours & Co., Inc. (Highland and Trail Ridge mines), produced ilmenite, zircon, and staurolite. Ilmenite production increased substantially at both mines during the year. Zircon, recovered as a byproduct of ilmenite at the Trail Ridge plant, increased 87 percent in quantity and 108 percent in value; staurolite, recovered also as a byproduct, increased 49 percent in quantity and 46 percent in value over 1958. Ilmenite was used primarily in manufacturing pigments, zircon in producing hafnium-free zirconium metal, and staurolite in manufacturing cement.

Florida Solite Corp., a wholly owned subsidiary of Southern Lightweight Aggregate Co., completed construction of a plant for manufacturing lightweight aggregate for structural concrete and masonry units. The company reported production of miscellaneous clay from its Russell mine for the first year.

Collier.—Collier was the only county in the State reporting petroleum and natural gas production, all from Sunniland Field. Petroleum production for the year decreased 6 percent from 1958. Natural gas production remained about the same as in 1958.

Sunniland Limerock Co. (Sunniland quarry), Naples Rock and Paving Co. (Ochopee quarry), and Industrial Limerock, Inc. (Sunniland quarry) crushed limestone for concrete aggregate, roadstone, and screenings; most was transported by truck. Output was 454,000 tons valued at $607,000, an increase of 3 percent in tonnage and 43 percent in value over 1958.

Columbia.—Loncala Phosphate Co. (Fort White mine), only mineral producer in the county, mined soft-rock phosphate, which was processed at its Lake City Junction plant. Tonnage and value decreased considerably from 1958. The material was used for agriculture.

Dade.—Dade was second in the State in value of mineral production. The county moved from fourth in 1957 to third in 1958 and to its present second ranking position in 1959, primarily due to increased portland and masonry cement production. Production of both cements trebled that of 1958, making cement the most important commodity in the county in terms of value. Lehigh Cement Co. (Miami mill) produced both masonry and portland cements. General Portland Cement Co. produced masonry cement for the first year, and portland cement for the second year at its Everglades mill.

For the second consecutive year, Dade County was the leading county in the State in output of crushed limestone. Total county production was 7 million tons valued at $9.1 million, a decrease of 6 percent in tonnage and 3 percent in value from 1958. Eleven companies crushed limestone at 14 quarries. Leading producers were Maule Industries, Inc. (Red Road and two other quarries), Oolite Crushed Stone Co. (Richmond quarry), and Three Bays Improvement Co. (Rockdale and Hialeah quarries). Most production was used in cement manufacture, concrete, and roadstone. Material was transported primarily by truck, and a small amount by rail and water.

Sand and gravel output increased 23 percent but decreased 5 percent in value from 1958. Des Rochers Sand Co., Inc. (Cape Florida mine), produced paving sand, Sample Rock Co., Inc. (Opa Locka mine), produced fill sand, and Golden Brown Soil Co. (Miami mine), produced sand for fill and lawn dressing and paving gravel totaling 221,000 tons valued at $132,000. Substantial increases in outputs were recorded by all three companies.

The City of Miami (Hialeah limekiln) produced lime for use as a water-softening and purification agent in a municipal water plant. Tonnage and value decreased from 1958.

Perlite, Inc., expanded perlite at its processing plant at Hialeah and set a record year; production and value more than doubled over 1958.

Production of gem stone and mineral specimen was recorded for the first year from the county. The Hobby House, Reed Springs, Missouri, produced coral rock; Rock and Shell Shop, Miami, quartz crystals; and C. R. Kiesel, assorted shells for sale as souvenirs.

Duval.—Titanium Alloy Manufacturing Division of National Lead Co. (Skinner mine), produced ilmenite and rutile and byproducts zircon and monazite. Rutile Mining Co. of Florida reported shipments of rutile and monazite previously produced at its Jacksonville mine. The company ceased mining in 1958. Production and shipments of all heavy minerals increased considerably.

Tennessee Products and Chemical Corp. expanded perlite at its processing plant near Jacksonville and increased tonnage and value slightly over 1958. Zonolite Co. exfoliated vermiculite from out-of-State sources at its Jacksonville location.

United States Gypsum Co. calcined gypsum for use in manufacturing building products at its Jacksonville plant. The company announced a plant expansion, which would increase capacity by 25 percent, to meet greater demand in Florida and the Southeast for wallboard, plaster base, and gypsum sheathing. Kaiser Gypsum Co. of Oakland, Calif., took an option on property east of Dames Point, near Jacksonville, for a proposed gypsum plant. Primary engineering for the plant was reportedly underway but planned capacity was not disclosed.

White Shell Corp. (White Shell plant) crushed oystershell for use as poultry grit; output decreased slightly from 1958, but value increased 11 percent.

Escambia.—Ward Gravel Co. (Century mine) and Campbell Sand and Gravel Co. (Flomaton mine) mined building sand and building gravel, and Clark Sand Co. (Pensacola mine) produced building sand only. Total output of the three mines was 476,000 tons valued at $476,000, an increase of 34 percent in tonnage and value over 1958. The material was transported about equally by railroad and truck.

Flagler.—Flagler ranked fourth in value of mineral production for the second consecutive year. Lehigh Portland Cement Co. (Coquina quarry), crushed limestone at its Bunnell plant for manufacturing cement. Output decreased 17 percent in tonnage and 22 percent in value. Shipments of portland cement by Lehigh decreased for the first year since production was begun in 1951, and masonry shipments declined to a new low for the first year since 1957.

Gadsden.—Florida and Gadsden County ranked first in the Nation in the production of fuller's earth; the county, for the second year, ranked seventh in the State in total value of mineral production. Total output of fuller's earth was 245,000 tons valued at $6.1 million—over 60 percent of national production—an increase of 17 percent in quantity and 20 percent in value over 1958. Increases have been recorded every year since 1948 except 1949 and 1952. Minerals and Chemicals Corp. of America (La Camelia mine), Magnet Cove Barium Corp. (Havana mine), and Floridin Co., Inc. (Quincey mine), produced fuller's earth for use in rotary-drilling muds, as a filtering agent, as filler in insecticides and fungicides, and in manufacturing chemicals. The Floridin Co., Inc., was acquired by the Pennsylvania Glass Sand Co. of Lewistown, Pa., in an expansion program. Florida Gravel Co. (Chattahoochee mine), produced 229,000 tons of sand and gravel valued at $383,000, an increase over 1958. Appalachee Correctional Institute (Chattahoochee mine), produced miscellaneous clay for use in manufacturing brick.

Gilchrist.—The Loncala Phosphate Co. (Mona mine), mined soft-rock phosphate and was the only mineral producer in the county; tonnage and value decreased 17 and 14 percent, respectively. The material was used in direct application to the soil and in stock and poultry feed.

Gulf.—Michigan Chemical Corp. produced magnesium compounds and lime for the first year from its new magnesium oxide plant near Port St. Joe. The plant used sea water as its source of oxide and was larger than the firm's brine-fed, 50-tons-per-day magnesium oxide plant at St. Louis, Mich. The product was chemical- and refractory-grade magnesium oxide for manufacturing basic brick and other refractory products, rubber, paper, and ceramics.

Hendry.—Caloosa Rock Corp. (La Belle quarry) crushed limestone for concrete aggregate, roadstone, and screenings; tonnage increased 65 percent, and value more than trebled over 1958. Caloosa was the only mineral producer in the county.

Hernando.—The county ranked fifth in the State in total value of mineral production and third, for the second year, in output of crushed limestone. Total production was 4.9 million tons valued at $8.3 million, an increase of 68 percent in quantity and 88 percent in value. Producers, in order of output, were Florida Rock Products Co. (Lansing quarry), Camp Concrete Co. (Gay quarry), Brooksville Rock Co. (Broco quarry), William P. McDonald Corp. of Fla. (Conrock quarry), Aripeka Limerock Co., Inc. (Aripeka quarry), and Lansing Rock Co., a new producer for the year. The material was transported primarily by railroad and truck and was used for concrete, roadstone, railroad ballast, and agriculture.

Hillsborough.—The county ranked third in value of mineral production, dropping from second in 1958, and led the State in peat production for the second year. General Portland Cement Co. (Tampa mill) manufactured portland and masonry cement; shipments and value of portland decreased slightly from 1958, and shipments of masonry decreased considerably, establishing the lowest year since production was begun in 1955. American Cyanamid Co. (Sydney mine) and the American Agricultural Chemical Co. (Boyette mine) produced land-pebble phosphate rock. Output increased 16 percent in quantity and 5 percent in value over 1958. The phosphate material was used for manufacturing phosphorus, for direct application to the soil, and for manufacturing ordinary and triple superphosphates.

Bay Dredging & Construction Co. (Lease No. 639) dredged oystershell in the Tampa area. Tonnage increased 20 percent and value 45 percent over 1958. The output was used for concrete, roads, and poultry grit. Raymond W. Grant, Charles H. Weber, and The Science Center recovered agatized coral from the Tampa Bay area for sale to gem and mineral collectors.

Holmes Nurseries (Tampa), Ruth C. McKissick (Limona), and E. Stearns' Peat (Sydney) produced 15,000 tons of peat valued at $39,000. Both reed-sedge and humus peats were recovered; most was used for soil conditioning.

Indian River.—Florida Minerals Co. (Vero mine) mined beach sands containing ilmenite, rutile, and zircon. Shipments and value for both ilmenite and rutile decreased; shipments of zircon reached the lowest year on record, but value increased over 1958. Airlite Processing Corp. of Fla., expanded perlite at its processing plant near Vero Beach and used material from out of State; tonnage and value increased 56 percent over 1958.

Lafayette.—Williston Shell Rock Co. (Dell quarry), the only mineral producer in the county, crushed limestone for use in concrete and as roadstone; output was 203,000 tons valued at $183,000, more than treble that of 1958, and set a record high for this company.

Lake.—The county ranked third in the State in production of sand and gravel. Davenport Sand Co., Inc. (Clermont mine), Central Sand Co. (Tavares mine), and Silver Lake Estates (Leesburg mine) mined sand for building, paving, and fill; total output was 794,000 tons valued at $573,000, an increase of 58 percent in tonnage and 59 percent in value over 1958. Most of the sand was transported by truck.

Lee.—Fort Myers Shell Co. (Lease No. 1082) and Fort Myers Dredging Co. (Lease No. 1218), a new producer, dredged oystershell in the Fort Myers area for concrete and roads; total output of both companies, compared with only one in 1958, more than trebled. West Coast Rock Co. (Fort Myers quarry) crushed limestone for use in concrete, roadstone, and screenings; production and value increased over 1958, setting a record year for the company. Shell and Jungle Factory collected shells for sale to tourists and collectors.

Leon.—Middle Florida Sand Co. (Tallahassee mine) and Johnson Sand Co. (Norfleet mine) produced building sand. Johnson was active for the first year since 1956. Total tonnage and value increased over 1958. All sand was transported by truck.

Levy.—Four companies crushed limestone at four quarries, compared with six companies at seven quarries during 1958; County output decreased 40 percent in tonnage and 29 percent in value. United Limerock Co. (Williston quarry), Dixie Lime Products Co. (Lebanon quarry), Connell and Schultz (Williston quarry), and Levy County Limerock Co. (No. 1 quarry), in order of output, were the active producers during the year. The stone was used for concrete, roadstone, and screenings and was transported in the main by railroad, although one company used truck haulage exclusively.

Manatee.—Southern Dolomite Co. (Palmetto quarry) crushed limestone for agricultural purposes and used both rail and truck haulage for transporting the stone. Tonnage and value increased 32 percent over 1958. Bradenton Dredging and Shell Co. (Lease 61) crushed oystershell for concrete and roadstone; output decreased from 1958.

Marion.—Three companies crushed limestone at four quarries; tonnage increased 18 percent and value 22 percent. Producers, in order of output, were Dixie Lime Products Co. (Kendrick quarry), Ocala Limerock Co. (No. 7 Kendrick quarry), and Cummer Limerock Co. (Kendrick and Martin quarries). The stone was used for concrete, roadstone, screenings, and agriculture. Transportation was by rail and truck. Dixie Lime Products Co. and Ocala Limerock Co. both established new records for output. Dixie Lime Products Co. (Ocala No. 1 limekiln) produced lime for building and chemical purposes; output decreased, but value increased slightly. Superior Phosphate Co. (Superior mine) produced soft-rock phosphate for the first year since 1954. Output was the largest since production was begun.

Monroe.—Charley Toppino and Sons, Inc. (Stock Island quarry) crushed 127,000 tons of limestone valued at $242,000; output decreased considerably from 1958. Keystone Art Co. (Winleys Key quarry) quarried dimension limestone for building.

Orange.—Daetyler Peat mine (Orlando) and Raymond Johnson (Apopka) produced 8,800 tons of humus and reed-sedge peat; output decreased from 1958. The material was used primarily as a soil conditioner.

Palm Beach.—Belle Glade Rock Co. (Belle Glade quarry), and Palm Beach County Highway Department (Palm Beach County quarry) crushed limestone for concrete and roadstone; County output decreased because of substantially lower production by the Palm Beach County Highway Department. Latham Farms (West Palm Beach) produced 4,800 tons of peat and more than doubled its 1958 output—humus peat was used as a soil conditioner.

Pasco.—Camp Concrete Rock Co. (Ivy quarry) crushed limestone for concrete and roadstone. The company reported for the first year and was the only mineral producer in the county. All material was transported by truck.

Pinellas.—Benton and Co., Inc. (Lease 460) dredged and crushed oystershell for use in concrete and road material; tonnage more than doubled, and value increased 60 percent over 1958. All material was transported by waterway. Largo Washed Sand Co. (Largo mine) produced building sand but at tonnage reduced from 1958. Mrs. Ray F. Bowman (Clearwater) collected 200 pounds of selenite crystals valued at $50 from a dredging operation.

Polk.—The leading mineral-producing county in the State for several years accounted for 40 percent of State mineral-production value, a total of $65.8 million, compared with $63.4 million for 1958. Increases were due to high output of phosphate rock, the major commodity, and sand and gravel. Eight companies produced marketable land-pebble phosphate rock at twelve mines. Four companies, Davison Chemical Co. Division of W. R. Grace Co., International Minerals and Chemical Co., Swift and Co., and Virginia-Carolina Chemical Co. each operated two mines. Companies operating only one mine were American Agricultural Chemical Co. (South Pierce mine), American Cyanamid Co. (Orange Park mine), Armour Fertilizer Works (Armour mine), and Smith-Douglass Co., Inc., (Tenoroc mine). Leading land-pebble phosphate companies in order of total output from all mines were: International Minerals and Chemical Co.; Davison Chemical Co., Division of W. R. Grace Co.; and American Agricultural Chemical Co. Leading individual producers with single mines were American Agricultural Chemical Co. and Armour Fertilizer works.

American Cyanamid Co. (Orange Park) built a new phosphate washer employing flotation on coarse feed. Orange Park mine operated over 2 years without a disabling injury. The Armour Agricultural Chemical Co. set up two major divisions—fertilizer and nitrogen phosphate—in a major company realinement. The Florida phosphate mining and processing facilities became part of the Nitrogen Phosphate Division. Smith-Douglass Co., Inc., discontinued the name Coronet Phosphate Division and used its corporation name thereafter to identify all operations. The company added a new scrubbing unit at its Plant City plant to remove fluorine and other impurities from phosphate rock. Davison Chemical Co. Division of W. R. Grace Co. awarded a contract for construction of a new 400-ton-per-day contact sulfuric acid plant at Bartow. International Minerals and Chemical Co. placed its Florida phosphate and chemical operations in a new Agricultural Chemicals Division (a major realinement), enlarged its Bonnie plant at a cost of $2.8 million, signed a new 3-year labor contract covering the Bonnie plant, and continued its research program on air pollution. Virginia-Carolina Chemical Corp. announced plans for building a $5 million triple superphosphate plant at Nichols, which would double its present production. The company joined with the Tampa Electric Co. and Peabody Coal Co. to form two new shipping firms—Gulf Transit Co. and Mid-South Towing Co.—to ship coal from Peabody mines in West Kentucky and Illinois to Tampa's Gannon steamplant. On the return trip, phosphate rock and other products would be moved to east Texas coast and Mississippi River points. Kentucky Land Co. purchased 2,700 acres of phosphate land in the Bone Valley District, between Bartow and Ft. Meade, at a cost of $8.5 million.

Polk County led sand and gravel producers in the State; the three leading producers in the State were in Polk County.

Sand and gravel output totaled 3.3 million tons valued at $2.4 million, an increase of 20 percent in tonnage and 16 percent in value over 1958. Nine companies produced building and paving sand from nine mines. Leading producers were Mammoth Sand Co. (Lake Wales mine), Standard Sand and Silica Co. (Standard mine), and Oak Ridge Sand Co. (Achan mine). Other mines were, in order of production of value, Gall Silica Mining Co., Inc. (Davenport mine), MacCalla Bros. (Polk County mine), Lake Wales Independent Sand Co. (Independent mine), Lake Wales Concrete Sand Co. (Lake Wales mine), Davenport Sand Co. (Mammoth mine), and Waverly Road Sand Co. (Winter Haven mine). Standard Sand and Silica Co. produced sand for building, paving, blasting, filtration, and other industrial uses.

Putnam.—Putnam County was second in the State in output of sand and gravel. Sand totaling 1.2 million tons valued at $1 million was produced during the year, compared with 1.0 million tons valued at $845,000 in 1958. Gravel output was extremely small, and total value was less than $100. Six companies produced sand at six mines, principally for construction uses; two companies produced industrial sand in addition to construction sand. Leading producers were Edgar Plastic Kaolin Co. (Edgar mine), Diamond Interlachen Sand Co. (Interlachen mine), and Keuka Sand Co., Inc. (Putnam County mine). Other producers were, in order of output, United Clay Mines Corp. (Crossley mine), All-Florida Sand Co. (Interlachen mine), and Keystone Sand Co. (Grandin mine). Material was transported by rail and truck.

Edgar Plastic Kaolin Co. (Edgar mine) and United Clay Mines Corp. (No. 4 mine) produced kaolin for use in pottery and stoneware, floor and wall tile, and clay crucibles. Production increased slightly over 1958.

Putnam County ranked third in the State in output of peat. Glen Saint Mary Nurseries Co. (Glen Saint Mary) and Traxler's Peat Co. (Florahoma), a new producer, mined humus peat for use as a soil conditioner.

St. Lucie.—Sand and gravel output was reported for the first year since 1956. Dixie Sand Co. produced construction sand for fill purposes and transported all of the material by truck. Early in the year, Davison Chemical Co., Division of W. R. Grace Co., began constructing a $500,000 addition to its fertilizer plant at Ft. Pierce.

Sumter.—Central Quarries, Inc. (Sumterville quarry), and Nobleton Rock Co., a new producer reporting for the first year, crushed limestone for concrete, roadstone, and railroad ballast. Tonnage and value quadrupled over that of 1958. Most of the material was transported by truck.

Suwanee.—Live Oak Stone Co. (Live Oak quarry) crushed limestone for concrete and roadstone; the company was the only mineral producer in the county.

Taylor.—Buckeye Cellulose Corp. recovered lime from hard water used in the wood pulp plant and reported output for the first year. The plant produced 76,000 tons of lime valued at $763,000. Sludge from the plant water-softening system was at first considered unusable because of a high content of magnesium compounds, but this problem was eliminated by carbonating the sludge with stack gas from the limekilns, thereby dissolving the magnesium compounds. The sludge was then dewatered in a centrifugal filter and fed to the kilns along with lime and mud from causticizing operations. The plant used about 40-million gallons of water per day.

Volusia.—White Sand and Materials Co. (New Smyrna Beach mine), the only producer in the county, mined building sand. Output increased over 1958.

Walton.—Bay Towing and Dredging Co. (Lease Nos. 753 and 1207) dredged oystershell for concrete and roads. Tonnage and value increased 28 percent over 1958.

The Mineral Industry of Georgia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Georgia.

By James L. Vallely[1] and Garland Peyton[2]

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THE MINERAL industry of Georgia continued to expand in 1959; record production was valued at $86.3 million, an increase of 15 percent over 1958. Output of cement, kaolin, feldspar, scrap mica, granite, marble, and slate reached new highs. Fuller's earth, miscellaneous clay, sheet mica, sand and gravel, talc, bauxite and manganese ores attained new peaks both in tonnage and value. Barite, limestone, sandstone, iron ore, manganiferous ore, coal, and peat declined from the previous year.

Clays and stone comprised 84 percent of the total production value and all nonmetallics totalled more than 98 percent of the value.

Among the States, Georgia led in output of kaolin and crude iron oxide pigments, was second in fuller's earth and mica, third in bauxite, fourth in barite and feldspar, and sixth in talc.

TABLE 1.—Mineral production in Georgia[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	2,942	$31,253	3,352	$36,232
Coal	9	44	7	34
Gem stones	(2)	(3)	(2)	(3)
Iron ore (usable)....thousand long tons, gross weight	209	1,008	186	945
Manganese ore....short tons, gross weight	(4)	(4)	1,547	(5)
Mica, sheet....pounds	15,102	82	18,461	119
Peat....short tons	4,491	(4)	4,288	(4)
Sand and gravel	2,631	2,693	2,909	2,982
Stone	12,129	31,108	13,771	35,973
Talc and soapstone....short tons	(4)	(4)	53,692	107
Value of items that cannot be disclosed: Barite, bauxite, cement, feldspar, iron oxide pigments, manganiferous ore, mica (scrap), and values indicated by footnote 4		10,145		10,979
Total Georgia[5]		75,106		86,262

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] The total has been adjusted to eliminate duplicating the values of clays and stone.

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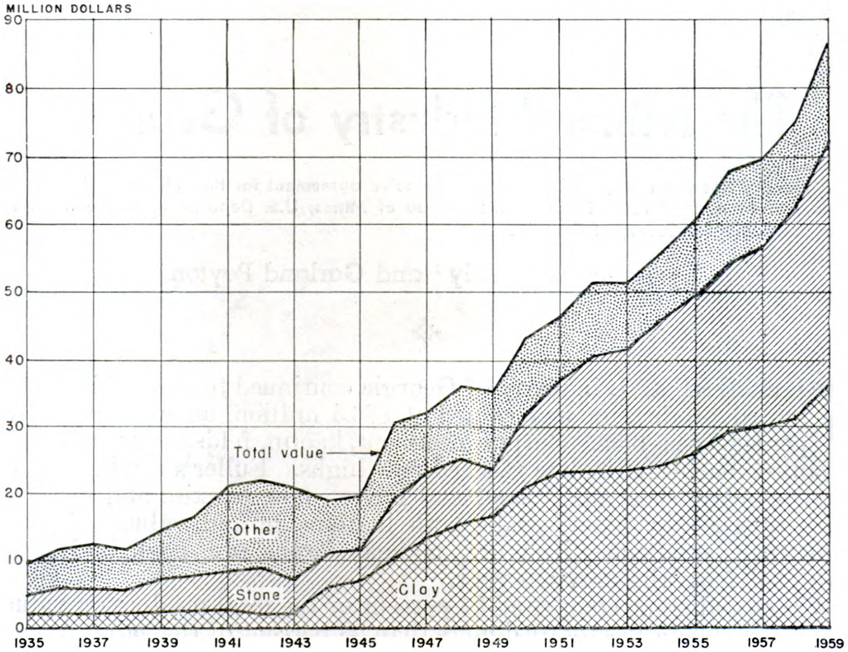

FIGURE 1.—Value of clays and stone, and total value of mineral production in Georgia 1935–59.

Employment and Injuries.—Employment in the mineral industries continued to increase in 1959. Both the number of men working daily and days active were above 1958. Total man-hours worked was 15 percent higher than the previous year. Only metal mining showed fewer man-hours worked.

The injury record improved over 1958. Only two fatalities occurred, both in quarries and mills, compared with six in 1958. The overall injury-frequency rate was 13 percent lower; no injuries were recorded for coal or metal mines. The injury-frequency rate for quarries and mills decreased 29 percent; that for nonmetal mines was up 8 percent and that for sand and gravel mines increased 25 percent.

Trends and Developments.—Heavy demand for construction materials helped raise Georgia's mineral production to a new record. During the year three new quarries for crushed granite and one for dimension granite were opened; five new sand producers were reported as well as one new producer, each, for miscellaneous clay and fuller's earth. Calcium Products Division of Georgia Marble Co. opened a new $100,000 grinding plant—dry grinding in tube mills, the first installed in the State, and classifying with air separators. Two clay producers began constructing new kilns for additional capacity in making brick, and Penn-Dixie Cement Corp. announced plans for new facilities to almost double the capacity of its Clinchfield plant.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1958							
Nonmetal mines	70	3,202	289	7,403,011	3	184	25
Quarries and mills	74	2,890	247	5,711,050	3	217	38
Sand and gravel mines	38	298	268	638,631	----------	8	12
Metal mines	19	161	139	178,810	----------	4	22
Coal mines	5	18	141	20,320	----------	----------	----------
Total	206	6,569	265	13,951,822	6	413	30
1959 [1]							
Nonmetal mines	79	3,580	286	8,184,558	----------	221	27
Quarries and mills	66	3,087	277	6,842,460	2	183	27
Sand and gravel mines	35	349	281	784,432	----------	12	15
Metal mines	19	153	123	150,281	----------	----------	----------
Coal mines	4	20	154	24,720	----------	----------	----------
Total	203	7,189	278	15,986,451	2	416	26

[1] Preliminary figures.

Bestwall Gypsum Co. completed a new $7 million plant for gypsum board, lath, and plaster at Brunswick in November, and an additional plant to make acoustical ceiling tile was under construction. National Gypsum Co. at Savannah completed an expansion program to increase capacity 25 percent to make its plant "the largest gypsum plant in the world."[3]

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Primary barite production declined for the second year after reaching record production in 1957; tonnage and value declined 19 and 22 percent, respectively. Crushed and ground barite were shipped principally for barium chemicals and well-drilling muds. Production came from Bartow County.

Cement.—Shipments of portland and masonry cements both established new records in quantity and value. Shipments of portland cement were up 8 and 7 percent, respectively, in quantity and value, and masonry cement rose 15 percent in both quantity and value. Out-of-State shipments were principally to Florida, with smaller tonnages to Alabama and South Carolina. Marquette Cement Manufacturing Co. produced portland and masonry cements at Rockmart and Penn-Dixie Cement Corp. manufactured portland cement only at Clinchfield. Penn-Dixie announced plans to increase its annual capacity 1.1 million barrels to 2.3 million barrels.

Clays.—Clay ranked first in the State in terms of value of mineral production and accounted for 42 percent of State total. Kaolin's steady upward trend continued, and production and value were 14 and 16 percent higher, respectively, than in 1958. Fuller's earth increased 18 percent in tonnage and 21 percent in value; miscellaneous clay was up 13 and 14 percent, respectively, in tonnage and value. Kaolin was produced in Baldwin, Richmond, Twiggs, Washington, and Wilkinson Counties; fuller's earth in Decatur, Grady, Jefferson, Thomas and Twiggs Counties; and miscellaneous clay in 12 counties. Georgia led the Nation in production of kaolin and ranked second in fuller's earth. Sixteen companies mined kaolin. The leading producers were: Georgia Kaolin Co., J. M. Huber Corp., Minerals and Chemical Corp. of America, and Southern Clays, Inc. Leading producers of fuller's earth were Cairo Production Co., Inc., The Diversey Corp., and Waverly Petroleum Products Co.

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[3] Pit and Quarry, vol. 52, No. 6, December 1959, p. 35.

Feldspar.—Appalachian Minerals Co. mined feldspar rock from several locations in Jasper County and produced flotation concentrate for glass and pottery uses at its mill near Monticello. Production was almost double that of 1958.

Gem Stones.—Various gem materials and mineral specimens were collected from the northern part of the State. Production value was less than $1,000.

Gypsum.—National Gypsum Co. calcined imported gypsum at Savannah.

Mica.—Sheet-mica production was 18,500 pounds valued at $118,900, including 5,265 pounds of full-trimmed sheet mica and 7,900 pounds of punch obtained from 131,600 pounds of hand-cobbed mica. All hand-cobbed and trimmed mica was sold to the Government through the General Services Administration (GSA) at the Spruce Pine (N.C.) purchase depot. Sheet mica production was 22 percent higher in quantity and 46 percent higher in value than in 1958. Scrap-mica production increased 33 percent. Ground mica was 13 percent higher in tonnage but decreased 16 percent in value. Scrap mica was mined in Cherokee, Hart, and Pickens Counties. Hart was the predominant sheet-mica-producing county. Minor quantities also were mined in Cherokee, Elbert, Franklin, Jasper, Monroe, Pickens, Rabun, and Upson Counties.

TABLE 3.—Kaolin and fuller's earth sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Baldwin	-----------	-----------	(1)	(1)
Decatur	(1)	(1)	(1)	(1)
Grady	(1)	(1)	(1)	(1)
Jefferson	12,989	$246,791	15,582	$311,640
Richmond	57,452	404,210	66,755	487,759
Thomas	(1)	(1)	(1)	(1)
Twiggs	953,302	17,292,760	1,047,732	19,392,919
Washington	388,628	7,148,097	560,283	9,244,089
Wilkinson	270,213	4,575,024	271,882	5,242,161
Other counties	98,044	1,107,121	77,257	1,005,643
Total	1,780,628	30,774,003	2,039,491	35,684,211

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 4.—Miscellaneous clay sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Bibb	(1)	(1)	(1)	(1)
Columbia	(1)	(1)	(1)	(1)
Crawford	300	$300	500	$500
Floyd	(1)	(1)	(1)	(1)
Fulton	44, 100	17, 640	(1)	(1)
Gordon	24, 000	9, 600	31, 000	12, 710
Houston	(1)	(1)	(1)	(1)
Macon	(1)	(1)	(1)	(1)
Polk	(1)	(1)	(1)	(1)
Richmond	(1)	(1)	(1)	(1)
Thomas	2, 600	1, 040		
Walker	(1)	(1)	85, 000	34, 850
Whitfield	(1)	(1)	29, 000	11, 900
Other counties	1, 090, 868	450, 018	1, 167, 249	487, 871
Total	1, 161, 868	478, 598	1, 312, 749	547, 831

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 5.—Kaolin sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Pottery and stoneware:						
Whiteware	60, 134	$1, 094, 550	$18. 20	71, 484	$1, 323, 704	$18. 52
Stoneware, including chemical stoneware	200	3, 554	17. 77	228	4, 122	18. 08
Art pottery, etc	733	5, 160	7. 04	(1)	(1)	(1)
Refractories:						
Firebrick and block	159, 772	1, 278, 095	8. 00	154, 777	1, 166, 156	7. 53
Glass refractories	13, 857	246, 239	17. 77	(1)	(1)	(1)
Foundries and steelworks	281	4, 993	17. 77	362	6, 545	18. 0
Saggers, pins, stilts, and wads	2, 074	36, 855	17. 77	3, 021	54, 620	18. 08
Architectural terra cotta	1, 130	20, 080	17. 77			
Fillers:						
Paper	477, 285	8, 387, 137	17. 57	577, 652	9, 684, 738	16. 77
Paper coating	704, 277	13, 896, 955	19. 73	749, 821	15, 005, 779	20. 01
Rubber	80, 059	1, 235, 269	15. 43	93, 433	1, 471, 323	15. 75
Linoleum and oilcloth	3, 674	65, 244	17. 76	3, 965	71, 687	18. 08
Paint	38, 446	771, 664	20. 07	47, 553	973, 816	20. 48
Fertilizers	1, 492	27, 948	18. 73	(1)	(1)	(1)
Plastics, organic	9, 548	215, 293	22. 55	9, 114	206, 666	22. 68
Chemicals	(1)	(1)	(1)	14, 416	250, 397	17. 37
Exports	11, 262	207, 114	18. 39	38, 255	821, 975	21. 49
Other [2]	132, 474	1, 852, 111	13. 98	176, 198	2, 923, 501	16. 59
Total	1, 696, 698	29, 348, 261	17. 30	1, 940, 279	33, 965, 029	17. 51

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes enameling, floor and wall tile, heavy clay products, insecticides and fungicides, portland and other hydraulic cements, catalysts, other refractory, other filler, and miscellaneous uses, and uses indicated by footnote 1.

Sand and Gravel.—Total sand and gravel production increased 11 percent in both tonnage and value. Sand was 14 and 16 percent higher, respectively, in tonnage and value; gravel declined 24 percent in tonnage and 26 percent in value. Structural, grinding, molding, blast, fire, and other sands were up both in tonnage and value. Engine and filter sands, although higher in tonnage, decreased in value; and sands for glass, paving, and railroad ballast declined both in tonnage and value. Twenty-nine companies produced sand in 22 counties, and two companies produced sand and gravel in Muscogee County. Crawford, Dougherty, Muscogee, Talbot, and Taylor were the principal producing counties. Atlanta Sand and Supply Co., Bannockburn Sand Co., Columbus Sand and Gravel Co., and Dawes Silica Mining Co. were the State's leading producers.

Stone.—Total stone production continued its steady increase. Both crushed and dimension stone rose 14 percent in tonnage; crushed stone rose 12 percent in value, and dimension stone 27 percent. Crushed granite increased 15 percent in tonnage and 10 percent in value, and crushed marble 44 percent and 30 percent, respectively. Crushed and ground slate increased 11 percent both in tonnage and value, and crushed limestone decreased 1 percent each. Dimension granite gained 17 percent in tonnage and 16 percent in value, and dimension sandstone 51 and 72 percent, respectively. Dimension marble was 1 percent lower in tonnage, but 34 percent higher in value.

TABLE 6.—Sheet mica produced, by counties

County	1958		1959	
	Pounds	Value	Pounds	Value
Cherokee	(1)	(1)	(1)	(1)
Elbert	(1)	(1)	(1)	(1)
Hart	12,600	$68,573	(1)	(1)
Jasper	32	319	(1)	(1)
Monroe	------	------	(1)	(1)
Pickens	(1)	(1)	(1)	(1)
Pike	2	29	------	------
Spaulding	(1)	(1)	------	------
Upson	1,542	8,608	409	$2,090
Other counties [2]	926	4,052	18,052	116,784
Total	15,102	81,581	18,461	118,874

(1) Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."
[2] Includes Cherokee, Elbert, Franklin, Hart, Jasper, Monroe, Pickens, and Rabun counties.

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Chattooga	4,167	$9,376	(1)	(1)
De Kalb	------	------	16,887	$13,400
Dougherty	242,134	181,811	282,833	201,464
Douglas	9,720	6,221	7,028	4,850
Elbert	(1)	(1)	2,600	3,000
Evans	2,956	4,434	9,051	7,096
Fulton	74,291	59,488	(1)	(1)
Montgomery	2,520	1,350	(1)	(1)
Sumter	23,468	8,692	------	------
Talbot	(1)	(1)	334,282	187,517
Taylor	170,451	77,937	(1)	(1)
Telfair	------	------	26,904	29,594
White	------	------	4,344	3,218
Other counties [2]	2,101,785	2,343,580	2,225,141	2,531,578
Total	2,631,492	2,692,889	2,909,070	2,981,717

(1) Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."
[2] Includes Bibb, Brooks, Chatham, Crawford, Effingham, Glynn, Long, Muscogee, Richmond, Spalding (1958), Tattnall (1959), Thomas, Ware (1958), and figures indicated by footnote 1.

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value	Average per ton	Short tons	Value	Average per ton
Structural sand	1,649,902	$1,133,745	$0.69	1,981,584	$1,446,211	$0.73
Paving sand	353,701	280,338	.79	326,981	225,090	.69
Paving gravel	103,000	154,500	1.50	(1)	(1)	(1)
Other sand and gravel [2]	524,889	1,124,306	2.14	600,505	1,310,416	2.18
Total	2,631,492	2,692,889	1.02	2,909,070	2,981,717	1.02

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

[2] Includes glass, molding, grinding, blast, furnace, engine, filter, railroad ballast, fill, ground, and other sands, and structural and paving gravel.

Stone was produced in 31 counties. Dimension granite was produced in 5 counties from 22 quarries, crushed granite in 17 counties from 23 quarries, and crushed limestone in Bartow, Floyd, Houston, and Mitchell Counties from 6 quarries. Crushed and dimension marble was produced in Pickens and crushed marble in Cherokee and Gilmer Counties. Crushed slate was mined in Bartow, Murray, and Polk Counties; quartzite in Richmond; dimension sandstone in Pickens; and byproduct quartz in Jasper. Leading producers of crushed granite were Stockbridge Stone Division of Vulcan Materials Co. and Weston and Brooker Co.; dimension granite, Coggins Granite Industries, Inc., Comolli Granite Co., and Davidson Granite Co. Georgia Marble Co. was the leading producer of crushed and dimension marble. Leading producers of crushed limestone were the two cement companies, Marquette Cement Manufacturing Co. and Penn-Dixie Cement Corp. Superior Stone Co. Division of American-Marietta Co. was the only producer of quartzite. Slate was mined for roofing granules by the Funkhouser Mills Division of Ruberoid Co. and Georgia Talc Co. and for manufacturing lightweight aggregate by the Georgia Lightweight Aggregate Co.

Three new quarries and a ground-marble operation were described in trade journals.[4] The Bureau of Mines published an information circular on the Camak quarry of Weston and Brooker.[5]

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[4] Trauffer, Walter E., New Weston and Brooker Crushed Granite Plant Last Word in Design: Pit and Quarry, vol. 51, No. 9, March 1959, pp. 80–86.

Trauffer, Walter E., Superior Stone Company Produces 10 Sizes at One Time—Up to 25 by Blending Capacity Doubled to 1,000 T.P.H.: Pit and Quarry, vol. 52, No. 5, November 1959, pp. 84–89, 95.

Herod, Buren C., Revised Primary, Surge Addition Spark Increase in Production: Pit and Quarry, vol. 52, No. 2, August 1959, pp. 104–106, 110.

Pit and Quarry, Calcium Products Division—Supplier to Modern Industry: Vol. 52, No. 5, November 1959, pp. 92–95.

[5] Pace, Norman A., and Schroeder, Harold J., Methods and Practices for Producing Crushed Granite, Weston-Brooker Co., Warren County, Ga.: Bureau of Mines Inf. Circ. 7874, 1959, 25 pp.

TABLE 9.—Crushed granite sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete, road metal	7,551,296	$12,014,224	$1.59	8,515,313	$12,578,639	$1.48
Railroad ballast	740,132	898,738	1.21	532,892	666,401	1.25
Riprap	(1)	(1)	(1)	115,301	201,876	1.75
Other	462,072	423,168	.92	925,791	1,269,068	1.37
Total	8,753,500	13,336,130	1.52	10,089,297	14,715,984	1.46

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

TABLE 10.—Dimension granite sold or used by producers, by counties

County	1958			1959		
	Cubic feet	Short tons (equivalent)	Value	Cubic feet	Short tons (equivalent)	Value
De Kalb	703,476	58,366	$787,248	780,634	66,355	$967,644
Elbert	537,181	45,536	1,470,605	565,247	47,725	1,410,882
Madison	132,000	11,000	396,000	167,819	14,300	503,457
Oglethorpe	273,350	22,792	557,544	(1)	(1)	(1)
Rockdale	-----------	-----------	-----------	(1)	(1)	(1)
Total	1,646,007	137,694	3,211,397	1,906,335	161,510	3,717,610

[1] Figure withheld to avoid disclosing individual company confidential data.

TABLE 11.—Dimension granite sold or used by producers, by uses

Use	1958			1959		
	Cubic feet	Value		Cubic feet	Value	
		Total	Average per cubic foot		Total	Average per cubic foot
Rough monumental	798,333	$1,724,139	$2.16	890,926	$1,896,755	$2.13
Curbing and flagging	330,608	487,764	1.48	490,300	856,879	1.75
Rubble	(1)	(1)	(1)	367,000	65,896	.18
Dressed monumental	132,354	696,610	5.26	(1)	(1)	(1)
Rough construction	1,205	400	.33	1,100	360	.33
Rough architectural	1,000	1,400	1.40	500	700	1.40
Other [2]	382,507	301,084	.79	156,509	897,020	5.73
Total	1,646,007	3,211,397	1.95	1,906,335	3,717,610	1.95

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes dressed architectural and uses indicated by footnote 1.

TABLE 12.—Crushed limestone sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value	Average per ton	Short tons	Value	Average per ton
Concrete and road metal	389,425	$702,465	$1.80	348,376	$622,509	$1.79
Railroad ballast	3,796	5,505	1.45	7,988	11,583	1.45
Other [1]	760,103	1,266,706	1.67	789,332	1,328,653	1.68
Total	1,153,324	1,974,676	1.71	1,145,696	1,962,745	1.71

[1] Includes agstone and other miscellaneous uses.

Georgia Marble Co., the State's leading mineral-producing company, continued to expand its operations. The company operated marble mines and quarries at Tate and Nelson and produced a wide variety of crushed and dimension marble products. In addition, the company acquired the physical properties of the Endsley Marble Co. at Friendsville, Tenn.; Consolidated Quarries Corp. at Lithonia, Douglasville and Decatur, Ga.; and the Alberene Stone Corp. of Virginia, during the year. Other operations of the company included limestone, marble, and granite quarries, at Wingdale, N.Y.; West Rutland, Vt.; Knoxville, Tenn.; Mineral Bluff, Ga.; and Sycamore and Russellville, Ala. Net sales for 1959 amounted to $17,560,000.[6]

Talc and Soapstone.—Production and value of crude talc and soapstone were considerably higher than in 1958. Sales of ground talc also were higher, but sales of sawed material declined. Cohutta Talc Co. and Georgia Talc Co., with mines and mills at Chattsworth, Murray County, were the only producers.

Vermiculite.—Exfoliated vermiculite was produced by Southeastern Vermiculite Co. at Macon, and Zonolite Co. at Atlanta.

METALS

Bauxite.—Production of bauxite increased 35 percent in tonnage and 40 percent in value over 1958. The greater part of the tonnage came from Floyd County and the remainder from Macon and Sumter Counties. American Cyanamid Co. was the only producer. Bauxite was dried at the Halls Station plant in Bartow County for shipment to chemical users.

Iron Ore.—Shipments of brown iron ore declined 11 percent in tonnage and 6 percent in value from 1958. This was the lowest tonnage produced since 1940. The Stewart-Webster County area, south of the Fall Line, accounted for 72 percent of all shipments. The remainder came from the Bartow-Polk County area in the northwestern part of the State. Leading producers were Brown-Nuggett Mining Co., Dunbar and Layton, and Laverne Mining Co.

Crude iron oxide pigments, sold or used, increased 9 percent in tonnage and decreased 10 percent in value. New Riverside Ochre Co. in Bartow County was the only producer. Finished pigments increased 6 percent in tonnage and 7 percent in value.

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[6] The Georgia Marble Co. Annual Report 1959.

Manganese.—Total manganese production increased 10 percent in tonnage and more than doubled in value over 1958. Most of the manganese ore (+34 percent Mn) was sold to the government through GSA before the close of the manganese purchase program in August. All other ore was shipped to steel companies. Manganiferous ore tonnage was 45 percent lower than in 1958, and the value was 39 percent lower. Except for a small tonnage mined in Polk County, production came from Bartow County.

MINERAL FUELS

Coal.—Two operators, excluding those producing less than 1,000 tons annually, mined bituminous coal from three underground mines in Walker County. Tonnage and value were 23 percent below 1958.

Peat.—Humus peat was produced in Lowndes and Screven Counties, principally for agricultural and horticultural uses. Tonnage decreased 5 percent and value 1 percent from 1958.

REVIEW BY COUNTIES

Mineral production was reported from 70 of Georgia's 159 counties. Nineteen counties had production valued above $1 million, 11 of which exceeded $2 million and made up 77 percent of State total production. The leading counties, in descending order, were: Twiggs, Pickens, Washington, Wilkinson, Houston, Polk, De Kalb, Gilmer, Bartow, Richmond, and Jones.

Baldwin.—General Refractories Co. mined kaolin for use in refractories.

Bartow.—Value of mineral production declined 7 percent from 1958. Lower barite and iron ore production were not offset by gains in manganese, crushed limestone, and slate.

TABLE 13.—Value of mineral production in Georgia, by counties [1]

County	1958	1959	Minerals produced in 1959 in order of value
Baldwin	------	(2)	Kaolin.
Bartow	$3,101,568	$2,888,907	Barite, slate, limestone, manganese ore, manganiferous ore, iron ore, iron oxide pigments.
Bibb	770,880	(2)	Sand and gravel, miscellaneous clay.
Brooks	(2)	(2)	Sand and gravel.
Chatham	(2)	(2)	Do.
Chattooga	9,376	(2)	Do.
Cherokee	(2)	(2)	Mica, marble.
Clarke	------	(2)	Granite.
Clayton	(2)	(2)	Do.
Cobb	(2)	498,000	Do.
Columbia	(2)	(2)	Miscellaneous clay.
Crawford	(2)	(2)	Sand and gravel, miscellaneous clay.
Dade	32,000	------	
Decatur	(2)	(2)	Fuller's earth.
De Kalb	(2)	(2)	Granite, sand and gravel.
Dougherty	(2)	201,464	Sand and gravel.
Douglas	(2)	(2)	Granite, sand and gravel.
Effingham	(2)	(2)	Sand and gravel.
Elbert	1,472,626	1,414,084	Granite, sand and gravel, mica.
Evans	4,434	7,096	Sand and gravel.
Fannin	15,600	10,470	Granite.
Fayette	(2)	(2)	Do.
Floyd	404,000	676,311	Limestone, bauxite, miscellaneous clay.
Franklin	------	(2)	Mica.

See footnotes at end of table.

TABLE 13.—Value of mineral production in Georgia, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Fulton	(2)	(2)	Granite, miscellaneous clay, sand and gravel.
Gilmer	(2)	(2)	Marble.
Glascock	(2)	----------	
Glynn	(2)	(2)	Sand and gravel.
Gordon	$9,600	$12,710	Miscellaneous clay.
Grady	(2)	(2)	Fuller's earth.
Gwinnett	(2)	(2)	Granite.
Hall	(2)	(2)	Do.
Hancock	(2)	(2)	Do.
Hart	(2)	(2)	Mica.
Henry	(2)	(2)	Granite.
Houston	(2)	(2)	Cement, miscellaneous clay.
Jasper	(2)	(2)	Feldspar, sandstone, mica.
Jefferson	246,791	311,640	Fuller's earth.
Jones	(2)	(2)	Granite.
Long	(2)	(2)	Sand and gravel.
Lowndes	(2)	(2)	Peat.
Macon	(2)	(2)	Miscellaneous clay, bauxite.
Madison	396,000	503,457	Granite.
Mitchell	(2)	(2)	Limestone.
Monroe	----------	(2)	Mica.
Montgomery	1,350	(2)	Sand and gravel.
Murray	(2)	146,084	Talc, soapstone, slate.
Muscogee	1,103,747	(2)	Granite, sand and gravel.
Oglethorpe	557,544	678,481	Granite.
Pickens	(2)	(2)	Marble, sandstone, mica.
Pike	29	----------	
Polk	(2)	(2)	Cement, slate, iron ore, miscellaneous clay, manganese ore, manganiferous ore.
Rabun	----------	(2)	Granite, mica.
Richmond	(2)	(2)	Sandstone, kaolin, miscellaneous clay and gravel.
Rockdale	----------	(2)	Granite.
Screven	(2)	(2)	Peat.
Spalding	(2)	----------	
Stewart	549,657	(2)	Iron ore.
Sumter	(2)	(2)	Bauxite.
Talbot	(2)	187,523	Sand and gravel.
Tattnall	----------	(2)	Do.
Taylor	77,937	(2)	Do.
Telfair	----------	29,594	Do.
Thomas	(2)	(2)	Sand and gravel, fuller's earth.
Towns	100	100	Gem stones.
Twiggs	17,292,760	19,392,919	Kaolin, fuller's earth.
Upson	8,710	2,121	Mica.
Walker	(2)	68,685	Miscellaneous clay, coal.
Walton	89,000	----------	
Ware	(2)	----------	
Warren	(2)	(2)	Granite.
Washington	7,148,097	9,244,089	Kaolin.
Webster	134,112	232,725	Iron ore.
White	----------	3,218	Sand and gravel.
Whitfield	(2)	11,900	Miscellaneous clay.
Wilkinson	4,575,024	5,242,161	Kaolin.
Undistributed	37,105,405	44,498,361	
Total	75,106,000	86,262,000	

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[1] The following counties are not listed because no production has been reported: Appling, Atkinson, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantley, Bryan, Bullock, Burke, Butts, Calhoun, Camden, Candler, Carroll, Catoosa, Charlton, Chattahoochee, Clay, Clinch, Coffee, Colquitt, Cook, Coweta, Crisp, Dawson, Dodge, Dooley, Early, Echols, Emanuel, Forsyth, Greene, Habersham, Haralson, Harris, Heard, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Lamar, Lanier, Laurens, Lee, Liberty, Lincoln, Lumpkin, McDuffie, McIntosh, Marion, Meriwether, Miller, Morgan, Newton, Oconee, Paulding, Peach, Pierce, Pulaski, Putnam, Quitman, Randolph, Schley, Seminole, Stephens, Taliaferro, Terrill, Tift, Toombs, Treutlen, Troop, Turner, Union, Wayne, Wheeler, Wilcox, Wilkes, Worth.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Barite producers were Paga Mining Co. and New Riverside Ochre Co. The latter company also was the only producer of crude and finished iron oxide pigments. Thompson-Weinman & Co. operated a grinding plant at Cartersville to produce fillers, or extenders, from barite, marble, mica, and other minerals. Funkhouser Mills Division of the Ruberoid Co. mined slate to produce slate flour and roofing granules. Marquette Cement Manufacturing Co. quarried limestone for use in its cement plant at Rockmart. Joe Mosteller and Mosteller Bros. were the only active iron-ore producers in 1959. Manganiferous ore and manganese ore were shipped by Lake Mining Co.; manganiferous ore by Mosteller Bros. and manganese ore by Oakland Heights Mining Co.

Bibb.—Three companies mined building and paving sand; Cornell-Young Co. was the principal producer. Burns Brick Co. and Cherokee Brick and Tile Co. produced miscellaneous clay for brick and other clay products. Southeastern Vermiculite Co. expanded crude imported vermiculite.

Brooks.—Bannockburn Sand Co. mined building, paving, and fill sand near Valdosta.

Chatham.—J. W. Fitzgerald Co., Inc., mined building sand, and National Gypsum Co. calcined imported crude gypsum at its Savannah plant for gypsum board, lath, and plaster. Plant capacity was increased 25 percent in 1959.

Chattooga.—Wolf Creek Sand Co. produced unwashed foundry sand.

Cherokee.—Georgia Talc Co. and Thompson-Weinman & Co. mined sericite (scrap mica), Arthur W. Moore produced full-trimmed mica, and Deweese Mining Co. produced hand-cobbed and full-trimmed mica. Teague Terrazzo Co. quarried and crushed marble for use as terrazzo.

Clarke.—Gainesville Stone Co. opened a new quarry for crushed granite near Athens.

Clayton.—Tyrone Rock Products Co. produced crushed granite from the new Clayton quarry opened in 1958.

Cobb.—Stockbridge Stone Division of Vulcan Materials Co. quarried and crushed granite for concrete and roadstone at the Kennesaw quarry.

Columbia.—Georgia Vitrified Brick & Clay Co. mined miscellaneous clay at the Campania mine.

Crawford.—Middle Georgia Pottery Co. mined miscellaneous clay at Lizella for use in the manufacture of clay products. Atlanta Sand and Supply Co. mined building, paving, and other sands near Gaillard.

Decatur.—Econo-Sorb Co., a new producer, and the Milwhite Co., Inc., mined and processed fuller's earth.

De Kalb.—Tonnage and value of dimension granite were higher than in 1958. Crushed granite, although greater in tonnage, had a lower production value. Producers of crushed granite were Consolidated Quarries Corp., Davidson Granite Co., and Stone Mountain Grit Co. Davidson Granite Co. produced dressed architectural stone, rubble, curbing, and flagging. J. T. Reagin Granite Co. and Stone Mountain Granite Corp. quarried granite for rubble, curbing, and flagging. Stamp Sand Co. was a new paving sand producer.

Dougherty.—Sand was the only mineral mined in the county. Five companies were active; the principal producers were Dawes Silica Mining Co. and Garrett Base Materials Products Co.

Douglas.—Consolidated Quarries Corp. produced crushed granite at Douglasville, and J. Tom Bell mined building sand for local use.

Effingham.—Dawes Silica Mining Co. mined building, blast, fill, filter, and molding sands.

Elbert.—Ten companies operated quarries for dimension granite. Comolli Granite Co. and Elberton Industries, Inc., produced both rough and dressed monumental stone. Rough monumental stone only was quarried by Coggins Granite and Marble Industries, Inc., Continental Granite Co., Elberton Granite Finishing Co., Harpers Quarry, Inc., M. W. Kantala & Sons, Robin Blue Quarries, Inc., A. G. & M. H. Veal, and Worley Bros. Granite Co. Bond Sand and Gravel Co. mined a small tonnage of building sand, and Joe L. Snyder produced full-trimmed mica.

Evans.—Evans Concrete Products Co. mined building and paving sand.

Fannin.—Fannin County Highway Department quarried and crushed granite for roadstone.

Fayette.—Tyrone Rock Products Co. produced crushed granite for concrete, roadstone, and railroad ballast.

Floyd.—American Cyanamid Co. mined bauxite from the Lennig and New Holland mines. Ready-Mix Concrete Co. and Floyd County Highway Department quarried and crushed limestone near Rome for concrete, roadstone, and railroad ballast. Oconee Clay Products Co. mined clay for use in its clay products plant at Milledgeville.

Franklin.—Ernest B. Wood produced a small quantity of full-trimmed mica.

Fulton.—Hitchcock Corporation and Stockbridge Stone Division of Vulcan Materials Co. quarried granite for concrete and roadstone. Atlanta Brick & Tile Co. mined clay for the manufacture of brick. W. J. Griffins and S. E. Thompson Bros. produced building and paving sand for local use. Zonolite Corp. exfoliated crude vermiculite shipped into the State at its Atlanta plant.

Gilmer.—Georgia Marble Co. mined and crushed marble for terrazzo and other uses at the Whitestone mine.

Glynn.—Gray Towing Co. produced structural and filter sands. Bestwall Gypsum Co. completed a new $7 million plant to manufacture gypsum board, lath, and plaster.

Gordon.—Plainville Brick Co. mined shale for use in its brick plant at Plainville.

Grady.—Cairo Production Co. mined and processed fuller's earth for absorbent uses.

Gwinnett.—The State Board of Correction and Stockbridge Stone Division of Vulcan Materials Co. produced crushed granite for concrete and roadstone.

Hall.—Gainesville Stone Co. quarried granite for concrete and roadstone.

Hancock.—Weston and Brooker Co. produced crushed granite for concrete, roadstone, and railroad ballast at Granite Hill.

Hart.—Funkhouser Mills Division of the Ruberoid Co. mined mica schist to produce ground mica. Joe L. Snyder produced full-trimmed mica, Arthur Mining Co. and E. B. Wood, hand-cobbed mica, and Payne Bros. and Henry Grindstaff both hand-cobbed and full-trimmed mica.

Henry.—Stockbridge Stone Division of Vulcan Materials Co. quarried granite for concrete, roadstone, and railroad ballast.

Houston.—Penn-Dixie Cement Corp. mined clay and limestone and manufactured portland cement at Clinchfield. Georgia Limerock Co. mined and crushed limestone for concrete, roadstone, and agricultural uses.

Jasper.—Appalachian Minerals Co. mined feldspar rock and produced flotation-grade feldspar. Mountain Mining Co. and Southern Mining Co. produced a small quantity of full-trimmed mica.

Jefferson.—Georgia-Tennessee Mining & Chemical Co. mined fuller's earth near Wrens for absorbent uses.

Jones.—Hitchcock Corp. (Gray quarry) and Weston-Brooker Co. (Ruby quarry) produced crushed granite for concrete, roadstone, and railroad ballast.

Long.—Dawes Silica Mining Co., Inc., mined building sand at Ludowici.

Lowndes.—Georgia Peat Moss Co. produced peat for agricultural and horticultural uses.

Macon.—American Cyanamid Co. mined bauxite from the Cavender mine, and Stephens Firebrick Co. mined clay for use in brick and other clay products.

Madison.—Coggins Granite and Marble Industries, Inc., quarried rough monumental granite from the Piedmont quarry near Carlton.

Mitchell.—Bridgeboro Stone Co., Inc., crushed limestone for concrete, roadstone, and agricultural purposes.

Monroe.—L. D. Gray produced a small quantity of full-trimmed mica.

Montgomery.—R. W. Geiger mined building and paving sand at Mt. Vernon.

Murray.—Cohutta Talc Co. and Georgia Talc Co. mined and processed talc at Chatsworth. Georgia Talc Co. also mined and crushed slate for roofing granules.

Muscogee.—Alabama Aggregates Co. Division of McCullough Industries and Stockbridge Stone Division of Vulcan Materials Co. quarried granite for riprap, railroad ballast, concrete, and roadstone. J. J. Brown Sand and Gravel Co. mined building and paving sand and gravel.

Oglethorpe.—Seven companies quarried dimension granite: Hoover Granite Quarries produced rubble, rough construction, architectural, and monumental stone; Bennie & Harvey, rough monumental and rubble; and American Granite Co., Dixie Granite Quarries, Enterprise Granite Co., and Oglethorpe Granite Co., rough monumental stone only. Liberty Granite Co. produced rough and dressed monumental stone.

Pickens.—Pickens County ranked second in the State in terms of value of its mineral production. Georgia Marble Co. quarried and dressed marble for building and monumental stone. Marble Products Co. of Georgia and Calcium Products Division of Georgia Marble Co. mined and crushed marble for terrazzo, filler, agricultural and other uses. Carl Johnson, Hardy Johnson, and North Georgia Stone Co. quarried dimension sandstone for flagging and rubble. Thompson-

Weinman & Co. mined scrap mica (sericite) at the Martin mine for grinding in its Cartersville plant. Teague and Young produced a small quantity of full-trimmed mica.

Polk.—Polk County ranked sixth in the State in value of mineral production with a 9-percent increase in value over 1958. Marquette Cement Manufacturing Co. produced portland and masonry cements at Rockmart from clay mined near the mill and limestone mined in Bartow County by the cement company. Georgia Lightweight Aggregate Co. mined and expanded slate for lightweight aggregate at Rockmart.

Three companies mined brown iron ore: Acree Mining Co., Arrington Mining Co., and Mundy Mining Co. Small and Ingram produced a small tonnage of manganese ore.

Rabun.—Rabun Quarries, Inc., produced crushed granite for concrete and roadstone, and T. B. Vance, Jr., mined a small quantity of full-trimmed mica.

Richmond.—Albion Kaolin Division of Interchemical Corp. mined refractory kaolin; Georgia-Carolina Brick & Tile Co. and Merry Bros. Brick & Tile Co. mined miscellaneous clay for manufacture of brick and other clay products. Superior Stone Co. became a division of American-Marietta Co. and continued to mine quartzite for concrete and roadstone at the Dan quarry.

Rockdale.—Kelly Granite Co., Inc., quarried dimension granite for rubble, curbing, and flagging.

Screven.—Atlanta Peat Co. produced humus peat near Sylvania for agricultural and horticultural use.

Stewart.—Brown iron ore production decreased 25 percent in tonnage and 21 percent in value. Leading producers were Dunbar and Layton, and Luverne Mining Co.

Sumter.—American Cyanamid Co. mined bauxite from the Easterlin, Holloway, and Thigpen mines.

Talbot.—Brown Bros. mined structural, paving, and molding sand; Taylor Sand Co. mined structural and paving sands.

Tattnall.—Phillips Sand Co. mined building sand for local use.

Taylor.—Butler Sand Co. and Howard Sand Co. mined building sand.

Telfair.—Clegg Bros. and Flanders Bros. mined building and paving sands.

Thomas.—Dawes Silica Mining Co. produced building, blast, glass, filter, molding, and other sands. Waverly Petroleum Products Co. mined and processed fuller's earth for absorbent uses.

Towns.—J. M. Steinoff collected a small quantity of corundum.

Twiggs.—Twiggs County continued to rank first in the State in value of mineral production. Georgia Coating Clay Co., Georgia Kaolin Co., J. M. Huber Corp., and Southern Clays, Inc., mined and processed kaolin for whiteware and pottery, refractories, chemicals, paper filling and coating, and many other filler uses. The Diversey Corp. mined and processed fuller's earth for insecticides, fillers, and absorbents.

Upson.—Southern Mining Co. produced hand-cobbed and full-trimmed mica; E. L. Clark and Joe L. Snyder produced small quantities of full-trimmed mica.

Walker.—Bituminous coal was mined by Carl Daniels Coal Co. and W. T. Blevins Coal Co. Key-James Brick Co. mined shale for the manufacture of brick at the Chattanooga, Tenn., plant.

Warren.—Weston and Brooker Co. quarried and crushed granite at Camak for concrete and roadstone, railroad ballast, and riprap.

Washington.—Washington County ranked third in the State in value of mineral production. Kaolin, the only mineral produced, was used for whiteware, tile, refractories, heavy clay products, paper filling and coating, many other filler purposes, chemicals, catalysts, and other uses.

Webster.—Brown iron ore production was 82 percent higher in tonnage and 74 percent higher in value. Producers were Brown-Nuggett Mining Co., E. L. Gammage, and Webster Mining Co.

White.—Helen Rock and Sand Co. mined building sand for local use.

Whitfield.—Dalton Brick & Tile Co. mined miscellaneous clay for manufacture of brick and other clay products.

Wilkinson.—Wilkinson County ranked fourth in the State in value of mineral production. Kaolin was mined principally for paper filling and coating, refractories, and rubber, by Evans Clay Co., Harbinson-Walker Refractories Co., D. C. Hardie, M & M Clays Co., Minerals & Chemical Corp. of America, and Oconee Clay Products Co.

The Mineral Industry of Hawaii

By L. E. Davis[1] and R. Y. Ashizawa[2]

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THE VALUE of mineral output in the State of Hawaii reached a record high of $7.6 million in 1959, from $6.3 million in 1958. Sand, gravel, and stone sold or used to meet the 50th State's accelerated building and paving requirements reached 3.5 million tons in quantity and $6.7 million in value, compared with 2.8 million tons and $5.5 million in 1958. Increases in the output of clays, lime, pumice (trachyte), and volcanic cinder also were substantial.

Military requirements, the influx of tourists and investors, and a migration of islanders to Honolulu to seek employment continued to create a need for additional hotel accommodations, family dwelling units, and structures for new service and supply outlets. Ownership of homes on newly available fee-simple land was a reason for much of the extensive suburban-residential development on Oahu Island.

Employment.—Hawaii's mineral industry reported 529 workers and 52 nonfatal lost-time injuries to the Federal Bureau of Mines for 1959. Based on the workers classified in the mineral extraction category by the Department of Labor and Industrial Relations, State of Hawaii, average weekly wages, including overtime, increased from $115 in 1958 to $131 in 1959.

TABLE 1.—Mineral production in Hawaii[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Lime	8,106	$260	(2)	(2)
Pumice	259,782	481	276,065	$548
Sand and gravel	438,495	1,112	463,124	1,253
Stone	2,377,073	4,446	3,033,647	5,480
Value of items that cannot be disclosed: Clays, gem stones (1959), salt (1958), and values indicated by footnote 2		13		363
Total Hawaii[3]		6,298		7,630

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total has been adjusted to eliminate duplicating the value of limestone used in lime.

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Consumption, Trade, and Markets.—All minerals produced in the State were consumed or processed within the State. Interisland shipments by barge were limited to sand and volcanic cinder from Molokai to Oahu, trachyte from the island of Hawaii to Oahu, and concrete aggregate from Oahu to Lanai. Shipments of mineral materials from the U.S. Mainland consisted chiefly of cements, petroleum products, natural asphalts, special construction materials, fertilizers, and salt.

Trends and Developments.—Suburban development on Oahu Island has encroached on some of the established plants and present and potential sources of raw mineral materials, including sand deposits. Complaints of new residents in their vicinity have compelled several producers to adjust blasting methods and haulage routes, install dust control, heighten smokestacks, and even look for other possible plant sites or mineral sources.

On some of the islands, accessible sources of aggregate material were limited to a few cinder and basalt or limestone deposits in the middle of and surrounded by sugarcane and pineapple fields. On Kauai Island, for example, the dredging of offshore coral reefs was necessary to supply paving material for plantation roads. The changeover in recent years from flume and rail to truck haulage of sugarcane from the fields to the mills has required wider and smoother plantation roads to accommodate the fast-moving fleets of heavy-duty semi and full trailers.

Legislation and Government Programs.—Statehood for Hawaii was passed by the Congress of the United States and signed by the President in March 1959. The State Reorganization Act of 1959 consolidated 84 Territorial agencies into 18 departments, including a Department of Land and Natural Resources. A legislative act to amend Hawaii's laws relating to strip mining, particularly for bauxite, was signed by the Governor on May 1, 1959.

Sampling of bauxite ore from the islands of Kauai, Maui, and Hawaii was completed by the Federal Bureau of Mines in June 1959; research on the beneficiation of the ore and the extraction of alumina was being done by the Bureau of Mines at Rolla, Mo., for the State government. Then the Federal Geological Survey began added investigations of bauxite ore on Kauai Island July 1, 1959. A preliminary report about the simulated mining and rehabilitation project on bauxite soils in the Wailua Game Refuge Area on Kauai Island was submitted to the State government in 1959 by a Mainland consultant.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—During World Wars I and II, cement was produced at lime plants on Maui and Oahu to alleviate shortages of cement shipped from the Mainland. By the end of 1959, Hawaiian Cement Corp. was constructing a $12 million cement plant at Barbers Point, Oahu Island, with an annual capacity of 1 million barrels. Permanente Cement Co. also was building a $13.5 million plant on Oahu near Lualualei, with an annual capacity of 1.7 million barrels. These companies were expected to be in production by the last half of 1960, using coral limestone from nearby quarry sites and gypsum from the Mainland.

Clays.—The consumption of clays produced on Oahu for use in manufacturing brick, tile and hollow block, and pottery, was substantially greater in 1959 than in 1958. GasprO, Ltd., Honolulu, used clays obtained from deposits at Kokokahi near Kaneohe. Much of the company output of clay products was used in constructing its new main office and merchandise building next to the plant. Clays from the former Wilson pit near Waimanalo were used by Waialae Tile, Ltd., at its plant in Honolulu.

Gem Stones.—Hawaii's output of commercially available gem material was limited to olivine and black coral. Pex of Hawaii, Honolulu, tumble-polished olivine gathered from Hawaii lava flows. The polished stones averaging one-quarter inch in diameter, were usually linked with gold wire into single and multiple strands of approximately 10 stones each for bracelets; longer strands were made for necklaces. Maui Divers of Hawaii, at Lahaina, Maui, made available to the islanders and to the tourist trade the rare black coral which had been found for years on the island shores. The source of the hard black gem was located in 1958 by skindivers while laying fishtraps in the waters between Lanai and Maui Islands. Self-contained underwater breathing equipment was used by the divers to reach a depth of more than 200 feet in the channel where a forest of treelike antipatharian coral exists. The precious gem was cut and polished at the Maui Divers lapidary, and with silver wire and mounts was fashioned into ringstones, brooches, cufflinks, and other freeform jewelry items.

Lime.—Sales of lime on Oahu and Maui showed a marked gain compared with 1958, owing to increased demand for lime used in masonry, and resumed shipments to the sugar industry, which experienced a 4-month strike in 1958. GasprO, Ltd., Oahu, produced lime near Waianae, using coral limestone. Hawaiian Commercial & Sugar Co., Ltd., operated its limekiln 2 miles west of Lower Paia, Maui, using coral sand from the adjacent beach.

Pumice (Volcanic Cinder).—High output of volcanic cinder in Hawaii for construction and maintenance of plantation roads continued. Shipments of volcanic cinder from Molokai to Oahu, for use as lightweight concrete aggregate, were begun toward the end of the year. The red and black cinders also were used for decorative fill, horsepens, plant soil, and building stone. A trachyte deposit at Puuwaawaa on Hawaii Island continued to yield a substantial quantity of lightweight aggregate for concrete and plaster. The material was used locally and shipped by barge to Oahu Island.

Salt.—Production of crude salt by solar evaporation at the West Loch of Pearl Harbor, near Honouliuli, Oahu, was discontinued by Chun Mew Ting Co. at the end of 1958 because its lease was about to expire. In past years, the crude salt was marketed as "Hawaiian Salt" and was used to cure or season meat, fish, and special foods.

Sand and Gravel.—Increased use of concrete by building contractors resulted in more output of sand required for blending with crushed basalt fines used as concrete aggregate. A substantial gain was noted in the use of coral dune sands from the northern shores of Oahu Island.

By yearend Honolulu Construction & Draying Co., Ltd., was prepared to barge sand from Molokai Island to supply some of Oahu's requirements for the critical material. Another source of sand was a new crushing and washing plant installed at Barbers Point by Oahu Aggregates, Inc., to process coral for roofing aggregate and several grades of pulverized concrete sand. The hydraulic and spiral-type classifiers used at the plant were believed to be the first of their kind in the Hawaiian Islands. Sand requirements on the neighboring islands were produced from beach, dune, and stream deposits. Basaltic streambed gravel was used primarily by county and plantation crews for road maintenance.

Stone.—*Basalt.*—The 1.9 million tons of quarried and crushed basalt sold or used in the Hawaiian Islands during 1959 was virtually unchanged from 1958. There was a shift, however, toward the finer grades required for concrete aggregate, and the average unit value was slightly higher. Quarries on Oahu were the source of 91 percent of the yield compared with 84 percent in 1958. Other basalt quarries were active on the neighboring islands of Hawaii, Kauai, Maui, and Molokai. Basalt rock, referred to as bluestone or bluerock in the Hawaiian Islands, was quarried and crushed for base course (particularly for asphaltic concrete for paving roads and parking areas), and for concrete for structural use. All Federal-aid highway projects required crushed basalt for surfacing Hawaii's blacktop roads. Other roads and airfield runway contracts allowed crushed limestone, in whole or in part. Crushed basalt fines were blended with beach or dune sands for use as concrete aggregate. Various grades of broken or crushed basalt were also used as riprap, roofing granules, and blast sand.

Limestone.—Six quarries on Oahu, one quarry on Kauai, and dredge operations on Kauai and Molokai Islands were the source of 526,000 tons of coral limestone sold or used during 1959, primarily for road construction. Oahu quarry operations yielded 476,000 tons of limestone, compared with 409,000 tons in 1958. Crushed limestone was used also for agricultural purposes and manufacturing lime, carbon dioxide, and concrete building products. Dredged coral was used extensively to construct and maintain plantation roads on Kauai, and to pave roads giving access to sand and cinder deposits on Molokai.

Miscellaneous Stone.—Fieldstone unearthed and piled at plantations, moss rock and One-Man,-Stone (can be lifted by one man) were used for retaining walls and decorative building facing. Portable crushers were moved to some of the field stone and boulder areas to process and utilize the product primarily for base course. Various pits and deposits on the Big Island (Hawaii) were sources of large quantities of Hawaiian aa (basaltic flow) rock, averaging 2 to 3 inches in diameter; these were removed by diesel power shovels and front end loaders and used for base course or crushed for asphaltic and Portland cement concrete aggregate. The island of Hawaii also was the source of an appreciable tonnage of weathered rock in various stages of decomposition. The decomposed rock, known as clinker on Hawaii, and eleku or half-rotten rock on Kauai, was used for fill and for surfacing tertiary roads.

Vermiculite.—Crude vermiculite from Montana was exfoliated by Vermiculite of Hawaii, Ltd., at its Honolulu plant, for heat and sound insulation, plaster and concrete aggregate, roofing, and agricultural use. The output was substantially greater than in 1958.

MINERAL FUELS

The 32,000-barrel-a-day refinery being constructed by Standard Oil Co. of California at Barbers Point, Oahu, was scheduled to begin production in October 1960. Late in 1959, the company decided to augment the project with a 13,000-barrel-a-day catalytic cracking plant with auxiliary alkylation, hydrogenation, and isomerization units; a sulfur recovery plant; and a carbon monoxide boiler. The additional units were expected almost to double the original construction cost of $33 million; they were scheduled for completion by mid-1962. Increased general business activity resulted in expansion of terminals and distribution facilities for petroleum products by other companies.

TABLE 2.—Value of mineral production in Hawaii, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Hawaii	$1,444,240	$1,374,934	Stone, pumice (volcanic cinder), gem stones.
Honolulu	4,482,717	5,317,011	Stone, sand and gravel, lime, pumice (volcanic cinder), clays.
Kauai	167,733	208,463	Stone, sand and gravel, pumice (volcanic cinder).
Maui	203,690	729,669	Stone, pumice (volcanic cinder), lime, sand and gravel, gem stones.
Total	6,298,000	7,630,000	

REVIEW BY ISLANDS

Hawaii.—Mineral material requirements for building or paving use on the Big Island were supplied from basalt, aa rock, decomposed rock, volcanic cinder, and trachyte deposits. James W. Glover, Ltd., quarried and crushed basalt rock at Hilo and Kawaihae, and aa rock at Kalopa, for base course and concrete aggregate. Asphaltic and Portland cement concrete batch plants and a concrete-block plant also were operated at the main company facility at Hilo. The 299th pit near Hilo Airport was a major source of aa rock used by several contractors for base course.

Volcanite, Ltd., quarried and crushed lightweight trachyte at Puuwaawaa—a cone over 1,200 feet in height. The lightweight aggregate was hauled to Kawaihae Harbor and barged to Oahu, where it was used for concrete aggregate; it was also trucked to Kona Tile, Ltd., near Kailua to be used for manufacturing lightweight hollow-block and tile. Corps Construction, Ltd., hauled aa rock from near Keauhou to its crusher about 3 miles southeast of Kailua. Crushed aa fines were blended with trachyte fines from Puuwaawaa for use as concrete sand. Approximately 6 miles southeast of Kailua, Oahu, J. M. Tanaka quarried and crushed basalt and aa rock for building and paving use.

Clinker rock, aa, and volcanic cinder pits and quarries along the highway between Hilo and Honokaa and in the Pahala and Naalehu areas yielded substantial quantities of paving material for construction and maintenance of sugarcane haul roads. Much of the material obtained near Kalopa was used as base course for highway construction. Local contractors and cattle ranchers excavated several pits between Honokaa and Kamuela during the year for fill. The county road department maintained rock crushers near Hawi, Kamuela, and approximately 7 miles west of Naalehu for repairing roads in areas far from producers of commercial crushed stone. Volcanic cinder pits near Kapoho, were principal sources of cinder used by county crews for patching roads and road shoulders. The maintenance crew at Hawaii National Park operated a crusher near Kau Desert to produce its own requirements of paving and fill material.

Kauai.—Grove Farm Co., Ltd., continued to operate Kauai's sole commercial basalt quarry at Huleia Stream toward the mountain (mauka), approximately 4 miles west of Puhi. Quarried stone was crushed for use as road base and in Portland cement and asphaltic concrete. The company also produced coral limestone from its quarry near Paoo Point, approximately 4 miles southeast of Koloa. The crushing plant near the quarry was used to process limestone as well as basaltic fieldstone unearthed at the sugarcane plantation. A cinder cone located 2 miles southeast of Koloa, enroute to the limestone quarry, provided material for surfacing company haul roads.

Lihue Plantation Co., Ltd., began using part of the 180,000 cubic yards of coral dredged from the reef off Kapaa by Hawaiian Dredging & Construction Co., Ltd., and stockpiled near Kapaa. Most of the coral was to be used in constructing haul roads in Kealia Division of the sugar plantation. Some of the coral dredged and stockpiled at Nawiliwili Harbor in 1956, also was used for maintenance of plantation roads. The McBryde Sugar Company coral limestone deposit adjacent to its factory waste-water ponds near Eleele was not worked during 1959. The company Kapeku cinder hill nearby yielded an appreciable quantity of aggregate material, used for road surfacing and, blended with sand from the Wahiawa Stream, as concrete aggregate in constructing pipes, ditches, and slabs.

Crews of the Kilauea Sugar Co., Ltd., quarried some decomposed rock near Kilauea Point for use in maintenance of plantation roads. A source near Kalihiwai Point supplied county road crews with eleku, or half-rotten rock. Coral sand used on Kauai for concrete aggregate and for patching roads and road shoulders was obtained mainly from beaches near Haena, Hanalei, Anahola, Kumukumu, Kealia, Makaweli, and Kekaha. The Waimea and Hanapepe Rivers were sources of basaltic gravel and sand used in 1959.

Hale Kauai, Ltd., operated its concrete batch plant at Nawiliwili, blending crushed basalt purchased from Grove Farm Co. with coral sand hauled approximately 16 miles from the Camp 10–C beach of the Lihue Plantation Co. Coral limestone chips and fines from Grove Farm Co. were used by Hale Kauai to manufacture hollow blocks. Other concrete products manufactured at Nawiliwili included drainpipes, curbings, and guardrail posts.

Maui.—Kahului Railroad Co. operated the island's only basalt quarry at Camp 10, about 3 miles west of Puunene, and produced crushed aggregate for building, paving, and railroad ballast and crushed fines for use as engine sand and in concrete. The company also operated a portable crusher and processed fieldstone unearthed and piled at plantations. Coral beach sand used by the company and by Nix Ready-Mix Co., Ltd., at Naska, was obtained from the Kaa area at Kahului Bay for blending with crushed basalt fines used in concrete. Nix Ready-Mix also manufactured concrete building blocks using black cinder from Puu (hill) Laina near the Wahikuli Reservoir, northeast of Lahaina. Crews from Baldwin Packers, Ltd.. also worked the Puu Laina cinder pit, as well as a pit near Honokohau Bay, for use in maintaining company roads. Pioneer Mill Co., Ltd., obtained its requirements for volcanic cinder and sand from near Launiupoko and Kaanapali, respectively. Hawaiian Commercial & Sugar Co., Ltd., obtained cinder from the Puuhele cinder pit at the junction of Highways 30 and 31 and purchased crushed basalt rock and sand from Kahului Railroad Co. for use in making concrete products in its plant at the junction of Highways 35 and 40. The company also produced hydrated lime near Lower Paia, using coral sand from the adjacent beach. The hydrated lime was used principally for clarifying sugar juice, adjusting acidity of pineapple juice, and in prepared masonry mortars. The Puu Pane cinder pit of the Haleakala Ranch Co., and the Puu Mahoe cinder banks of the Ulupalakua Ranch, Ltd., were sources of volcanic cinder used for roads, driveways, horsepens, and plant soil. Hawaii National Park obtained black cinder near the summit of Haleakala Crater to repair its roads and trails. County road-maintenance crews obtained volcanic cinder from various pits, and streambed gravel and boulders near Kealahou, Hana, Iao Valley, Wailuanui, and Honomanu gulches.

The black coral gem material, obtained from the deep waters between Maui and Lanai, was cut and polished by Maui Divers of Hawaii, at Lahaina, for use in jewelry.

Molokai.—Significant in the development of mineral resources of Molokai Island, Maui County, was the investment of more than $1 million by Honolulu Construction & Draying Co., Ltd., in facilities to barge sand and lightweight volcanic cinder to Oahu Island. The project, begun early in the year, included construction of a breakwater, a conveyor for loading barges, an aircraft landing strip at Hale O Lono, and haul roads to the Papohaku beach sand and Waieli cinder pit.

Molokai Rock & Equipment supplied all local requirements for basalt rock. The material was quarried and crushed at Manawainui Gulch, toward the sea (makai), approximately 3½ miles northeast of Kaunakakai. The Kaunakakai and Kapaakea cinder pits at Puu Maninikolo, near Kaunakakai, and the Puuluahine cinder pit 3 miles NNE of Kaunakakai were principal sources of volcanic cinder used locally for fill and road repairs. Streambed gravel, locally known as ililí, from the Kawela, Kamalo, and other gulches west of Kaunakakai were used for road shoulders, base course, and fill.

Oahu.—Value of the mineral output on Oahu Island in Honolulu County rose from $4.5 million in 1958 to $5.3 million. Honolulu Construction & Draying Co., Ltd., quarried basalt rock at its Kapaa operation near Kailua for base course and concrete aggregate. The aggregate was used at cement and asphaltic-concrete batch plants at Kapaa, Kaukonahua, Barbers Point, and Middle Street. Pipe, block, and other concrete products were manufactured at Middle Street. Toward the end of the year, the company began producing lightweight building block from volcanic cinder, which was barged from Molokai Island. Concrete Engineering Co., Ltd., subsidiary of HC&D, manufactured precast slabs and prestressed concrete members at Sand Island Road.

Clarke-Halawa Rock Co., which became a division of Pacific Cement and Aggregates, Inc., San Francisco, in April 1959 quarried basalt and also manufactured prestressed concrete members and precast sections at Halawa Valley near Aiea. The company produced crushed coral limestone for base course and crusher fines for concrete aggregate at Lualualei quarry which it acquired from Western Rock Products Co. The quarry was known formerly as the Mikilua quarry and was operated by the Kailua Limestone Co. Concrete batch plants were operated by Clarke-Halawa at Lualualei, Halawa and Barbers Point.

Pacific Concrete & Rock Co., Ltd., quarried basalt near Puu Palailai, Ewa, and coral limestone at its Kailua quarry. The company operated a batch plant and a concrete tile and block plant at Kailua, and batch plants at Ewa and near Sand Island Road. Hawaiian Rock & Supply Co., Ltd., operated its Kaena quarry near Camp Erdman. The Valley basalt quarry near Nanakuli was not worked during 1959, but the crushing plant processed rock purchased from the Ewa (Palailai) quarry. Nanakuli Paving & Rock Co., Ltd., quarried coral limestone and produced crushed aggregate at the nearby Testa quarry for building and paving use.

GasprO, Ltd., produced quicklime and hydrated lime near Waianae, utilizing coral limestone from an adjacent quarry. The crushed limestone also was used for concrete aggregate and roadstone and for producing carbon dioxide at the company gas plant in Honolulu. The Kahuku Plantation Co. and the Ewa Plantation Co. quarried coral limestone near Kahuku and Barbers Point, respectively, for use in construction and maintenance of sugarcane haul roads. County crews operated the Laie quarry, and maintenance crews at Schofield Barracks worked the quarry and crusher at Kolekole Pass for paving and fill purposes. The Waianae area was the principal source of moss rock gathered for use as decorative landscape and building stone on Oahu.

New cement plants of the Hawaiian Cement Corp. at Barbers Point, and Permanente Cement Co. near Lualualei, were under construction. Hawaiian Cement ordered its kiln and ballmills from Copenhagen, Denmark, and Permanente Cement arranged for delivery of its kiln from the U.S. Mainland. Clay used for brick, tile, and other products was obtained near Kokokahi by GasprO, Ltd., and near Waimanalo by Waialae Tile, Ltd. Coral sand, required for blending crushed basalt fines used in Portland cement concrete aggregate, was obtained mostly from dune deposits between Camp Erdman and Waimea in northern Oahu. Black cinder deposits off Makiki Round Top Road in Honolulu, yielded appreciable quantities of black sand used as decorative fill for patios and golf courses, cushion sand under drainpipes, and plant soil. Vermiculite of Hawaii, Ltd., exfoliated crude vermiculite from Montana at its Honolulu plant for lightweight aggregate and agricultural use.

The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the Idaho Bureau of Mines and Geology.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and Norman S. Petersen [1]

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IDAHO mining operations yielded products valued at $70.2 million in 1959, a gain of 9 percent over 1958. The increase was due mainly to greater activity by the major lead-zinc mines, further development of the rapidly growing phosphate-rock industry, and expanding requirements for gravel in highway construction.

In order of value, products contributing 90 percent of the State mineral-production total were silver, lead, zinc, sand and gravel, phosphate rock, and copper. Base-metal and silver mines in Shoshone County supplied 63 percent of the total value of minerals.

Trends and Developments.—Important developments took place in 1959 in nonmetals industries. J. R. Simplot Co. began constructing a plant to process high-grade clays near Bovill, Latah County, and increased the capacity of its Pocatello fertilizer-manufacturing plant; Central Farmers Fertilizer Co. started producing elemental phosphorus and phosphate fertilizers at Georgetown, Bear Lake County; and The Bunker Hill Co. began building a phosphate-fertilizer plant at Kellogg, Shoshone County.

Totals for 1949 through 1959 showed strong upward trends in production of phosphate rock and sand and gravel, smaller gains in the output of other nonmetals such as clays and pumice, and sharp declines in the output of metals. Some metal-mining activities ceased, or nearly so, including those relating to cobalt, tungsten, lode and placer gold, antimony-gold ore, and a sizable segment of the lead-zinc industry. However, mercury and silver production recorded substantial gains.

Employment and Injuries.—According to the Idaho Employment Security Agency, the number of workers in stone and clay products and in the phosphate fertilizer, elemental phosphorus, and sulfuric acid industries increased substantially, whereas employment in primary-metals processing remained steady. Nonmetal mining recorded a small gain. Metal-mining employment continued its long-term decline owing to mine closures.

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[1] Commodity-industry analyst, Division of Mineral Resources, Region I, Bureau of Mines, Albany, Oreg.

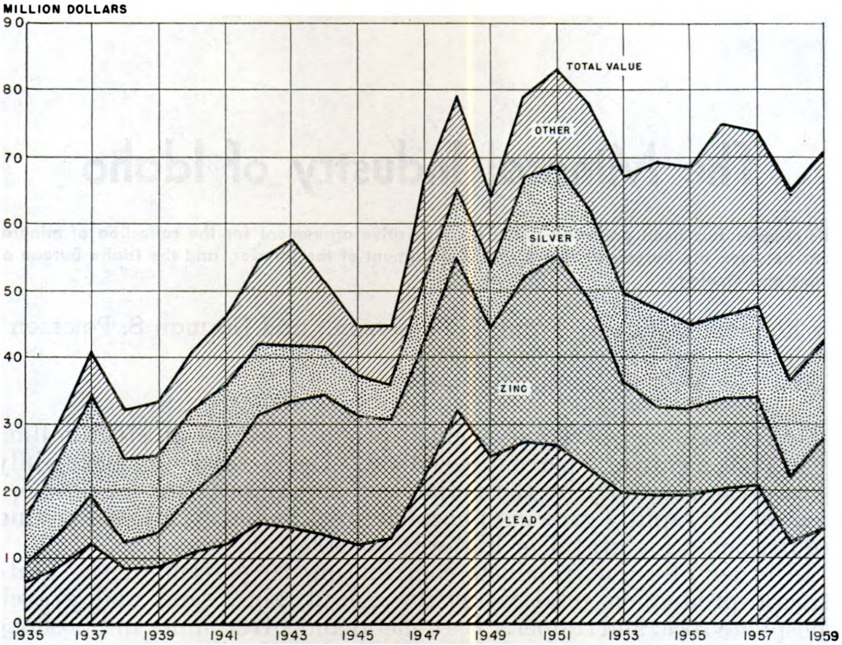

FIGURE 1.—Value of silver, lead, and zinc and total value of mineral production in Idaho, 1935–59.

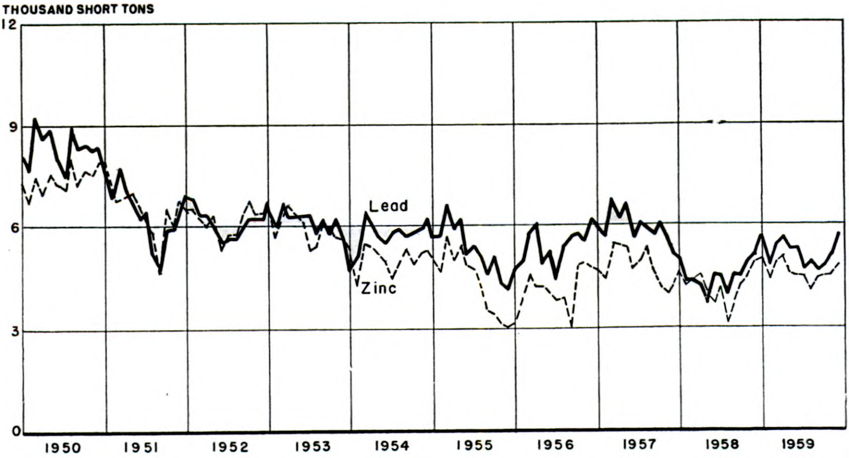

FIGURE 2.—Mine production of lead and zinc in Idaho, 1950–59, by months, in terms of recoverable metals.

TABLE 1.—**Mineral production in Idaho**[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate antimony content	677	(2)	678	(2)
Clays [3] thousand short tons	27	$20	39	$33
Cobalt (content of concentrate) thousand pounds	3,078	(2)	1,141	(2)
Columbium-tantalum concentrate (oxide content) thousand pounds	397	(2)	189	(2)
Copper (recoverable content of ores, etc.)	9,846	5,179	8,713	5,350
Gold (recoverable content of ores, etc.) troy ounces	15,896	556	10,479	367
Iron ore (usable) thousand long tons	1	14	6	56
Lead (recoverable content of ores, etc.)	53,603	12,543	62,395	14,351
Mercury 76-pound flasks	2,625	601	1,961	446
Mica:				
Sheet pounds	1,968	14	(2)	(2)
Scrap	1	(4)	------------	------------
Nickel (content of ore and concentrate)	29	(2)	(2)	(2)
Phosphate rock thousand long tons	1,291	5,652	1,610	7,412
Pumice and volcanic cinder thousand short tons	108	172	93	137
Rare-earth metals concentrate	692	(2)	522	80
Sand and gravel thousand short tons	[5] 6,879	[5] 6,404	9,184	8,080
Silver (recoverable content of ores, etc.) thousand troy ounces	15,953	14,438	16,636	15,057
Stone thousand short tons	[5] 1,391	[5] 1,794	1,079	1,931
Titanium concentrate gross weight	2,223	(2)	(2)	(2)
Uranium concentrate (oxide content) pounds	(2)	(2)	9,978	30
Zinc (recoverable content of ores, etc.)	49,725	10,144	55,699	12,811
Value of items that cannot be disclosed: Barite, cement, abrasive garnet, gem stones, gypsum, peat, tungsten (1958), and values indicated by footnote 2. Excludes value of limestone used in manufacturing cement	------------	7,117	------------	4,068
Total	------------	[5] 64,648	------------	70,209

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Incomplete total, fire clay included with items that cannot be disclosed.

[4] Less than $500.

[5] Revised figure.

Average weekly earnings of production workers in mining increased over 1958, because of a longer average workweek and higher hourly earnings.

Injury statistics for the Idaho mining industry, published in this chapter, are based on reports to the Bureau of Mines from the individual companies.

Legislation and Government Programs.—Two new contracts with government financial participation of 50 percent were approved by the Office of Minerals Exploration (OME), U.S. Department of the Interior, for exploration at the Copper Queen mine (Copper Queen Mining Co., Lemhi County) and the Pilot lead-zinc claims (Abot Mining Co., Shoshone County). Nine other projects continued active under the Government program for encouraging exploration for strategic and critical minerals.

TABLE 2.—Average employment and total wages (thousand dollars) in mining and mineral manufacturing, by industries [1]

Year	Mining							
	Metals		Nonmetals		Fuels		Total	
1955	4,112	$20,012	297	$1,334	28	$88	4,437	$21,434
1956	4,498	23,161	268	1,210	26	94	4,792	24,466
1957	4,388	23,716	249	1,123	21	84	4,658	24,923
1958	3,633	19,359	259	1,281	27	149	3,918	20,789
1959	3,305	18,393	292	1,379	20	127	3,617	19,899

Year	Mineral manufacturing							
	Stone and clay products		Primary metals		Phosphate fertilizers, elemental phosphorus, and sulfuric acid		Total	
1955	427	$1,691	1,120	$5,409	797	$3,994	2,344	$11,094
1956	458	1,894	1,173	6,399	861	4,655	2,492	12,948
1957	451	1,980	1,232	6,818	880	4,932	2,563	13,730
1958	579	2,760	1,034	5,314	787	4,518	2,400	12,592
1959	664	3,228	1,036	5,656	[2] 1,139	[2] 6,834	2,839	15,718

[1] Idaho Employment Security Agency. Industry groups may not correspond to those in the Bureau of Mines canvass.

[2] Part of the 1958–59 gain was due to obtaining information in better detail from multiestablishment employers. Some of this gain formerly was carried under the employer's original industry code 202, food processing.

TABLE 3.—Hours and earnings of production workers in mining [1]

Annual average	1955	1956	1957	1958	1959
Weekly earnings	$89.69	$97.11	$101.02	$95.68	$101.91
Hourly earnings	$2.22	$2.34	$2.47	$2.53	$2.58
Weekly hours	40.4	41.5	40.9	37.7	39.5

[1] Idaho Employment Security Agency.

TABLE 4.—Injury experience in the mineral industries

	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1958						
Quarries and mills [1]	222	206	366,357	----------	2	5
Nonmetal mines and mills	315	218	548,351	----------	8	15
Sand and gravel operations	269	163	350,211	----------	7	20
Metal mines and mills	3,453	247	6,816,812	2	482	71
Coal mines	----------	----------	----------	----------	----------	----------
Total	4,259	237	8,081,731	2	499	62
1959 [2]						
Quarries and mills [1]	225	119	214,798	----------	1	5
Nonmetal mines and mills	228	234	427,294	----------	9	21
Sand and gravel operations	199	153	242,841	----------	4	16
Metal mines and mills	2,779	277	6,153,521	3	301	49
Coal mines	----------	----------	----------	----------	----------	----------
Total	3,431	256	7,038,454	3	315	45

[1] Includes cement and lime processing plants.
[2] Preliminary figures.

TABLE 5.—Office of Minerals Exploration contracts active in 1959

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
BLAINE					
Silver Star-Queens Mines, Inc.	Queen of the Hills	Lead, zinc	Apr. 25, 1955	$235,780	50
Viking Mines, Inc	Garfield	do	May 16, 1958	36,846	50
CUSTER					
Clayton Silver Mines	Clayton	do	July 19, 1957	130,840	50
Salmon River Scheelite Corp.	Tungsten Jim	Tungsten	Apr. 21, 1955	129,136	75
LEMHI					
Calera Mining Co	Sunshine	Cobalt, copper	June 27, 1958	104,200	62½
Capital-Seaboard Corp	Long Dike	do	June 24, 1958	65,200	62½
Golden Copper Queen Mining Co.	Copper Queen mine.	Copper	Sept. 3, 1959	40,270	50
OWYHEE					
Mac D. Mining Corp	Lucky Boy	Mercury	June 6, 1958	6,748	50
SHOSHONE					
Abot Mining Co	Pilot group	Lead, zinc	June 23, 1959	43,550	50
American Smelting and Refining Co.	East Page	do	Sept. 18, 1957	660,208	50
Hecla Mining Co	Silver Mountain	do	Oct. 21, 1954	1,435,880	50

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Byproduct antimony was recovered by Sunshine Mining Co. in Shoshone County at about the 1958 rate. The metal was obtained from ore from the Sunshine mine and from adjoining properties worked by the firm on a profit-sharing basis. The company reported that a market for the antimony was being developed among secondary smelters and producers of antimonial-lead products. The material being sold was a cathode metal resulting from electrolysis of a leach solution applied to a silver-copper-antimony concentrate; the product averaged 95 percent antimony and 5 percent arsenic.

The Bunker Hill Co. produced small quantities of high-grade antimony metal for use in making transistors. A refining process developed by the company made a product having less than 0.01 percent impurities, according to the company, and small lots were sold both to foreign and domestic industry.

Antimony also was recovered as antimonial lead from concentrates shipped to the Bunker Hill lead smelter. This production of antimony is not identifiable as to source and is not included in the State mineral-production totals.

Cadmium.—Domestic and foreign ores and concentrates that were treated at The Bunker Hill Co. smelter in Shoshone County contained considerable cadmium. The Bunker Hill firm reported a record production of 825,103 pounds of electrolytic cadmium, a gain of 9 percent over 1958. Sales increased markedly from about 557,000 pounds in 1958 to nearly 820,000 pounds in 1959.

Cobalt.—Output of cobalt by Calera Mining Co. at the Blackbird mine in Lemhi County was 63 percent less than in 1958. The company stopped producing cobalt concentrate in June when enough material was stockpiled to make possible fulfillment of cobalt metal delivery commitments under Government contracts. Milling of ore from the company open pit to recover only the copper, gold, and silver content was continued throughout the year, but complete shutdown was anticipated early in 1960 unless the Government contract was extended.

The last of the cobalt concentrate on hand at the company refinery at Garfield, Utah, was treated in August, and the plant was closed.

Columbium-Tantalum.—Shipments of columbium-tantalum-bearing material by Porter Bros. Corp. declined 52 percent (oxide content of concentrate) from 1958. Production, consisting of columbium-tantalum oxides in euxenite concentrate, was shipped to Mallinckrodt Chemical Co., St. Louis, Mo., under Government contract. No shipments of columbite concentrate were made to the General Services Administration (GSA) purchase depot at Custer, S. Dak., because purchases for the Federal columbium-tantalum stockpile program were terminated at the end of 1958.

The Porter company production was obtained from gravels worked by two dredges in Bear Valley, Valley County. Dredge output, a black-sand concentrate, was trucked to Lowman for milling. Products from the mill were euxenite, columbite, monazite, ilmenite, magnetite, and garnet concentrates. Dredging and milling activity was discontinued in October when total output reached the quantity specified in the company contract with the Government.

Copper.—Output of recoverable copper was 1,133 tons (12 percent) less than in 1958, but the value was 3 percent more because of a higher average price for copper during the year. Reduced production of cobalt-copper ore in Lemhi County at the Blackbird mine (Calera Mining Co.), source of more than one-half of this metal in Idaho, accounted for most of the decline. After completion of a Government purchase contract for cobalt in the spring, the Calera company began milling stockpiled low-grade ore, recovering only the copper, gold, and silver. The milling rate reportedly was about double the previous rate of 1,000 tons a day because of the lower-grade material being processed. A large tonnage of copper concentrate was stockpiled at the company rail shipping point at Mackay because of industry-wide smelter strikes.

In the lead-zinc-silver mining area of Shoshone County the Galena mine of American Smelting and Refining Co. and the Sunshine mine of the Sunshine Mining Co. also yielded byproduct copper. Output from these mines comprised most of the remainder of the State total.

Gold.—Curtailed operation of the Blackbird cobalt-copper mine of Calera Mining Co. was primarily responsible for the decline of 34 percent (5,417 ounces) in gold output (see "Cobalt"), but the firm continued to be by far the largest producer of gold in the State. Approximately equal quantities of byproduct gold from lead-zinc-silver mines in Shoshone County and gold from various placer operations in the State, particularly the Gold Bar placer in Idaho County, comprised the remainder of the output. Placer gold recovery was about 600 ounces (24 percent) less than in 1958.

Iron Ore.—Iron-ore shipments increased from 1,443 long tons in 1958 to 5,500 tons in 1959. All of the ore was from mining operations in Iron Mountain in Washington County near Weiser. Shasta Mining Co. shipped most of the ore from stocks before October, when the company lease on the property was relinquished to Glen Clark. Clark mined about 1,300 tons of ore and shipped some ore in the latter part of the year.

The magnetite ore was shipped to a steel mill and foundries at Portland, Oreg., and to a cement manufacturing plant near Lime, Oreg

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousand)	Value (thousands)
1950-54 (average)	132	43	2,723	37,718	$1,320	15,256	$13,807
1955	109	34	1,961	10,572	370	13,831	12,518
1956	104	21	2,071	9,210	322	13,472	12,193
1957	93	20	2,100	12,301	431	15,067	13,637
1958	85	31	1,681	15,896	556	15,953	14,438
1959	47	24	1,834	10,479	367	16,636	15,057
1863-1959 [3]			138,715	8,289,000	193,257	703,568	524,730

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950-54 (average)	3,089	$1,625	78,874	$23,165	74,802	$21,591	$61,508
1955	5,618	4,191	64,163	19,121	53,314	13,115	49,315
1956	6,656	5,658	64,321	20,197	49,561	13,580	51,949
1957	7,912	4,763	71,637	20,488	57,831	13,417	52,735
1958	9,846	5,179	53,603	12,543	49,725	10,144	42,860
1959	8,713	5,350	62,395	14,351	55,699	12,811	47,935
1863-1959 [3]	167,000	68,183	6,898,000	937,894	2,180,000	444,286	2,168,350

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings and old slag re-treated, and ore shipped to smelters during the calendar year indicated. Owing to rounding, the totals of individual items may not be additive.

[2] Does not include gravel washed.

[3] Partly estimated for years before 1901.

TABLE 7.—Gold produced at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1950-54 (average)	18	1,600	9,148	24	7	114	42	1,606	9,262
1955	22	546	3,858	12	6	88	34	552	3,946
1956	13	350	2,484	8	2	38	21	352	2,522
1957	16	250	2,916	4	2	49	20	252	2,965
1958	13	92	2,501	18	7	89	31	100	2,590
1959	[1] 10	92	1,878	14	5	89	24	98	1,967

[1] Includes 2 dragline dredges, 4 hydraulic operations, and 4 nonfloating washing plants; Bureau of Mines not at liberty to publish separately.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals [1]

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Blaine	5		9	(2)	19,834	$18
Boise	5	5	28	$1	1,294	1
Boundary	1				9	(2)
Custer	3		68	2	118,645	107
Gem	3		215	8	1,909	2
Idaho	2	8	1,533	54	114	(2)
Lemhi	5	3	5,807	203	15,723	14
Owyhee	1	2	13	(2)	55	(2)
Shoshone	17	1	2,349	82	16,460,825	14,898
Undistributed [3]	5	5	457	16	18,078	16
Total	47	24	10,479	367	16,636,486	15,057

County	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
Blaine	2	$1	182	$42	139	$32	$93
Boise							2
Boundary							(2)
Custer	37	23	958	220	96	22	375
Gem			6	1	4	1	12
Idaho							54
Lemhi	4,996	3,068	52	12	6	1	3,298
Owyhee							1
Shoshone	3,678	2,258	61,155	14,066	55,454	12,754	44,058
Undistributed [3]			42	10			42
Total	8,713	5,350	62,395	14,351	55,699	12,811	47,935

[1] Owing to rounding, the total of individual items may not be additive.
[2] Less than $500.
[3] Includes values and quantities that cannot be shown separately for Ada, Benewah, Bonner, Clearwater, Elmore, Jerome, and Valley Counties.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold, gold-silver, gold old tailings, and gold assay rejects[2]	10	1, 166	432	3, 103		12, 000	8, 000
Dry silver	13	435, 760	863	12, 488, 240	6, 357, 000	4, 863, 400	764, 700
Total	23	436, 926	1, 295	12, 491, 343	6, 357, 000	4, 875, 400	772, 700
Copper	3	379, 563	5, 626	14, 045	10, 035, 700		
Lead and lead assay rejects[2]	12	84, 927	597	1, 225, 404	267, 300	15, 344, 800	1, 670, 400
Lead-zinc and zinc[2]	10	848, 960	994	2, 868, 337	580, 800	100, 753, 000	92, 460, 100
Total	25	1, 313, 450	7, 217	4, 107, 786	10, 883, 800	116, 097, 800	94, 130, 500
Other "lode" material: Zinc: Old slag smelted	1	83, 329		37, 199	185, 200	3, 816, 800	16, 494, 800
Total "lode" material	47	1, 833, 705	8, 512	16, 636, 328	17, 426, 000	124, 790, 000	111, 398, 000
Gravel (placer operations)	24	(3)	1, 967	158			
Total	71	1, 833, 705	10, 479	16, 636, 486	17, 426, 000	124, 790, 000	111, 398, 000

[1] Detail will not necessarily add to total, because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] 97,708 cubic yards.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1959, by types of material processed and methods of recovery, in terms of recoverable metals

Method of recovery and type of material processed	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	106	73			
Concentration and smelting of concentrates: Ore	8, 093	16, 547, 215	17, 183, 400	120, 749, 300	94, 881, 100
Direct smelting:					
Ore and assay rejects[1]	313	24, 841	57, 400	223, 900	22, 100
Old slag		37, 199	185, 200	3, 816, 800	16, 494, 800
Total	313	62, 040	242, 600	4, 040, 700	16, 516, 900
Placer	1, 967	158			
Grand total	10, 479	16, 636, 486	17, 426, 000	124, 790, 000	111, 398, 000

[1] Combined to avoid disclosing individual company confidential data.

Lead.—Output of lead was higher than in 1958, when lead-zinc operations in Shoshone County were curtailed because of weak base-metal markets and consequent low prices. An apparent anomaly of greater production but lower average price for lead resulted from improved markets and prices for zinc and the consequent increased output of lead-zinc ores. The tonnage of lead recovered was 16 percent greater in 1959 than in 1958, but was considerably lower than the average of the preceding 10 years. The value of the lead output was only 14 percent more than in 1958, reflecting the slightly lower average price for the year.

The Bunker Hill mine (The Bunker Hill Co.) was again by far the largest producer; over 49 percent of the State output came from this mine. Other properties producing substantial quantities of lead were the Star (The Bunker Hill Co.), Page (American Smelting and Refining Co.), and Lucky Friday (Lucky Friday Silver-Lead Mines Co.).

Despite a continuing threat of a strike through much of the year, work at mines in Shoshone County and at The Bunker Hill Co. lead smelter and electrolytic-zinc plant was largely unaffected. Contract agreements were reached by a few companies with the unions involved. The mines and mills of other principal operators in the district, primarily American Smelting and Refining Co. and The Bunker Hill Co., were kept in operation by a series of short-term extensions of existing contracts.

Mercury.—Output of this metal was one-fourth less than in 1958. Rare Metals Corporation of America continued as the largest producer, recovering 1,736 flasks (76 pounds each) at its Idaho-Almaden open pit in Washington County compared with 2,114 flasks in 1958. The company furnaced 55,230 tons of ore containing 0.158 percent mercury; the quantity of ore mined was slightly less (54,989 tons).

Holly Minerals Corp.'s production at the Hermes mine (Valley County) was less than one-half the 1958 total; no mercury was recovered by the company during the last half of the year. The firm mined 11,074 tons of ore and treated 10,523 tons in its 200-ton-a-day flotation plant.

Nickel.—Nickel was contained in cobalt concentrate produced at the Blackbird mine, Lemhi County, by Calera Mining Co.

Rare-Earth Metals.—Production of rare-earth and thorium concentrates decreased from 692 to 522 tons (oxide content of concentrate) in 1959. Production comprised: (1) Rare-earth and thorium oxides contained in euxenite concentrate produced by Porter Bros. Corp. at columbium-tantalum dredging operation in Valley County; (2) monazite concentrate recovered by Porter Bros. Corp. dredges and by Baumhoff-Marshall, Inc., during reprocessing of stockpiled ilmenite concentrate at Boise (see "Titanium"); and (3) thorium concentrate obtained from ore mined by Agency Creek Thorium & Rare Metals Corp. in Lemhi County. Most of the decline was due to the smaller quantity of euxenite concentrate shipped by Porter Bros. Corp., as the firm completed deliveries to the Government under a contract for columbium-tantalum oxides. Trial quantities of thorite concentrate were shipped from properties being developed in the Salmon area of east-central Idaho. Monazite shipments decreased slightly.

Interest in thorite deposits in the State continued unabated. A former tungsten mill, moved to the property of Salmon River Uranium Development, Inc. (on the Salmon River near North Fork) and modified, was used to concentrate ore mined by Agency Creek Thorium & Rare Metals Corp. from claims being developed south and east of Salmon. Test work also was reported on thorite from Hall Mountain in Boundary County.

Silver.—Total silver output in Idaho was 4 percent higher than in 1958; all but a small part of the 16.6 million ounces was from mines in Shoshone County. The Sunshine Mining Co., at the Sunshine and adjoining properties, continued as the largest producer, followed by the Galena mine operated by American Smelting and Refining Co. Other mines with large silver production were the Bunker Hill (The Bunker Hill Co.), Silver Summit (Hecla Mining Co.), and Lucky Friday (Lucky Friday Silver-Lead Mines Co.).

Plans were announced in the latter part of the year to extend workings of the Sunshine mine to a depth greater than any other workings in the Coeur d'Alene mining region. The proposed new 4,300-foot working level would be about 420 feet below the existing lowest level of the mine and about 300 feet below the deepest workings of the Bunker Hill or Galena mines.

Titanium.—The sand-separation facilities of Baumhoff-Marshall, Inc., at Boise were acquired by J. R. Simplot Co. before midyear. From 1951 to 1955 this plant had processed dredge concentrate from monazite placer deposits near Cascade, Valley County. The ilmenite and zircon-quartz fractions recovered in the separation were stockpiled. After 1955, ilmenite, garnet, and additional quantities of monazite were recovered while reprocessing the stockpiled material. In 1959, total sales of ilmenite by the Baumhoff firm and after June by J. R. Simplot Co. were slightly higher than in 1958.

Uranium.—Ore was shipped from four uranium properties by three companies in Custer County. The Phillips Petroleum Co. (Coal Creek group), Vitro Idaho Minerals Corp. (East Basin Creek No. 1 property), and Sidney Mining Co. (Shorty group) supplied most of the production. The Sidney and Vitro firms shipped small tonnages from other locations in the county.

Zinc.—The tonnage of recoverable zinc extracted at Idaho mines was up 12 percent over 1958 and was slightly higher than the average of the preceding 5 years. The value of the zinc output was 26 percent more than in 1958 because of a higher average price for the metal in 1959. The Star mine of The Bunker Hill Co. led by a wide margin in output of zinc. Other principal sources were the Page and Bunker Hill mines and The Bunker Hill Co.'s dump-slag-processing operation, all in Shoshone County. Less than 0.5 percent of the zinc came from mines outside Shoshone County.

NONMETALS

Barite.—J. R. Simplot Co. resumed mining barite at the Sun Valley mine, Blaine County. Shipments of the material to the company's Pocatello grinding plant increased sharply over 1958. The ground barite was marketed for use as a weighting agent in oil-well-drilling mud and as an additive to fire-fighting fluids.

Cement.—Production and shipments of portland cement were 7 and 6 percent less, respectively, than in 1958. Output, as in previous years, was from the Inkom plant of Idaho Portland Cement Co., Bannok County. Most shipments were to destinations within the State. Smaller quantities were shipped to the Rocky Mountain area. Transport was principally by truck, although rail shipments were made to more distant markets.

Clays.—The quantity and value of clays sold or used by producers increased 38 percent over 1958. Greater output of miscellaneous clay used in making heavy-clay products, chiefly building brick, accounted for most of the increase. Miscellaneous clay was produced in Ada, Bonneville, Cassia, and Minidoka Counties. Fire clay produced near Helmer, Latah County, was used in manufacturing refractories at the Troy plant of A. P. Green Firebrick Co. Output of fire clay was substantially the same as in 1958.

Bentonite produced near Grandview, Owyhee County, was marketed for use in oil-well drilling muds, to seal earth-lined irrigation canals and reservoirs, and for filter purposes. Only a small tonnage was produced at this operation; however, output was double that in 1958.

J. R. Simplot Co. began constructing a $2 million clay-beneficiation plant west of Bovill, Latah County, in the fall. The plant was scheduled for completion in 1960 and was to process clay from local deposits into a product suitable for use as paper-coating and filler material. Silica sand would be produced as a coproduct.

Garnet (Abrasive).—Output of abrasive garnet by Idaho producers advanced 13 percent over 1958; however, shipments remained substantially the same. Production and shipments were from operations of Idaho Garnet Abrasive Co., Benewah County; Spokane Garnet Sand & Sales Co. (Shoshone County); Porter Bros. Corp. (Valley County); and the Boise plant of J. R. Simplot Co. (formerly Baumhoff-Marshall, Inc.). The garnet output of Porter Bros. was a byproduct of columbium-tantalum placer operations of the company in Bear Valley (Valley County). The Simplot company recovered garnet during the reprocessing of stockpiled ilmenite concentrate obtained from material dredged previously near Cascade, Valley County.

Gypsum.—Gypsum for agricultural use was produced at the Rock Creek gypsum mine northwest of Weiser, Washington County. Shipments were at a reduced rate compared with 1958.

Mica.—Production and shipments of mica by producers in Idaho dropped sharply from 1958. Output, largely from the mica-beryl operation of Western Mica Corp. near Deary, Latah County, was 8,820 pounds of hand-cobbed ruby muscovite mica in 1959. A quantity of hand cobbed mica was produced at one other operation near Deary. The entire output of hand-cobbed mica was purchased by the GSA purchasing depot at Custer, S. Dak., for stockpiling. Three tons of scrap mica was produced, but none of the material was reported as shipped.

Phosphate Rock.—Output of marketable phosphate rock by producers in Idaho advanced to 1.6 million long tons compared with 1.3 million tons in 1958. Production of phosphate-rock ore was 2.2 million long tons—an increase of 46 percent over 1958. Increased output at the Georgetown mine of Central Farmers Fertilizer Co. was the principal reason for the sharp rise; greater production at the Ballard mine (Caribou County) and the Gay mine (Bingham County) was a contributing factor. Phosphate rock was mined at four operations—two in Caribou County and one each in Bear Lake and Bingham Counties. The Waterloo mine of San Francisco Chemical Co. (Bear Lake County), and the Centennial mine of J. R. Simplot Co., (Clark County), were idle. A small shipment was made from stocks at the Waterloo mine early in the year.

Phosphate rock sold or used by producers was 1.6 million long tons—an increase of 11 percent over 1958. The largest use continued to be for manufacturing elemental phosphorous; consumption of rock for this purpose increased moderately. Phosphate rock used for making superphosphate, triple superphosphate, and wet-process phosphoric acid was less than in 1958.

Phosphate rock was reduced to elemental phosphorous at electric-furnace plants of Monsanto Chemical Co., Soda Springs; Westvaco Mineral Products Division, Food Machinery & Chemical Corp., Pocatello; and Central Farmers Fertilizer Co., Georgetown. The last-named firm utilized elemental phosphorous to manufacture phosphate fertilizers, and J.R. Simplot Co. continued producing prosphate fertilizers at a plant west of Pocatello.

The Idaho phosphate industry continued to expand in 1959. In September, Central Farmers Fertilizer Co. formally dedicated its multimillion-dollar phosphate-processing facilities and mine at Georgetown, Bear Lake County. Production of electric-furnace elemental phosphorous for use in making fertilizers was begun, and shipments of phosphate fertilizers and processed phosphate rock were made to member cooperatives.

J. R. Simplot Co. enlarged the productive capacity of its Pocatello plant. The expansion included installation of additional grinding, filtering, and evaporating equipment at the fertilizer plant and construction of a sulfuric acid plant adjacent to the fertilizer facility. Acid production was to be used by the company to manufacture fertilizers and wet-process phosphoric acid. In April the Simplot company, under contract agreement, assumed management and control of The Anaconda Co. phosphate mine and processing plant at Conda, Caribou County. A share of the production from the Conda operation was to be used at the Simplot Pocatello fertilizer plant. Simplot also was to supply the phosphate requirements of the Anaconda fertilizer plant at Anaconda, Mont.

Monsanto Chemical Co. contracted for construction of a private haulage road connecting the company elemental phosphorous plant at Soda Springs with the Ballard property 11 miles distant. The new road will enable the company to use specially constructed, heavy-duty 75-ton-capacity ore carriers to increase efficiency of ore haulage between the mine and plant.

In September The Bunker Hill Co. began constructing a $2 million phosphate fertilizer plant at Kellogg, Shoshone County, near its mining and metallurgical works. The plant was scheduled for completion by mid-1960 and initially was to produce phosphoric acid to be marketed as liquid fertilizer. Phosphate deposits near Elliston, Mont., were being developed by the company as a source of raw material for the plant. Byproduct sulfuric acid, produced from waste stack gases generated by roasting zinc concentrates at the nearby electrolytic-zinc plant, would be used to manufacture the wet-process phosphoric acid.

Pumice and Volcanic Cinder.—Pumice and volcanic cinder sold or used by producers in Idaho was 14 percent less than in 1958. Three pumice operations in Bonneville County supplied the bulk of the production. Volcanic cinder was produced in Canyon County, and a small quantity of crude pumice was mined in Twin Falls County. Output was used chiefly for manufacturing lightweight-concrete building blocks. A small quantity of crude pumice was used experimentally for miscellaneous purposes, such as feed-lot fill, chicken litter, and traction material.

Sand and Gravel.—Sand and gravel output rose to 9.2 million tons, an increase of 33 percent over 1958. Greater production was the result chiefly of increased requirements for road gravel by the State highway department; 80 percent more sand and gravel was produced for this agency than 1958. Of the sand and gravel produced in the State during the year, 90 percent was used for road construction and maintenance (89 percent in 1958), 8 percent for building and construction purposes (10 percent in 1958), and the remaining 2 percent for miscellaneous uses (1 percent in 1958). Production came from operations in 35 of the 44 counties in the State. The largest output was from Power County. Cassia, Ada, and Elmore Counties, all with outputs exceeding one-half million tons, ranked second, third, and fourth, respectively.

TABLE 11.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Sand and gravel	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Building	633	$863	679	$844
Road material	2,235	1,740	1,204	1,201
Railroad ballast	3	2	(1)	(1)
Other	78	34	219	174
Total	2,949	2,639	2,102	2,218
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	54	74	43	66
Road material	[2] 3,877	[2] 3,691	7,039	5,796
Total	3,931	3,765	7,082	5,862
ALL OPERATIONS				
Building	686	937	722	909
Road material	[2] 6,112	[2] 5,431	8,243	6,997
Railroad ballast	3	2	(1)	(1)
Other	78	34	219	174
Grand total [3]	[2] 6,879	[2] 6,404	9,184	8,080

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Revised figure.
[3] Owing to rounding, total of individual items may not be additive.

Stone.—Production of stone decreased 22 percent compared with 1958, largely owing to curtailed use of crushed stone by road-construction projects. Commercial producers crushed 24 percent less stone, and output for noncommercial uses (Government-and-contractor production) declined 21 percent. Basalt was the principal stone quarried, and the output was used chiefly for road construction and maintenance. Limestone was quarried in Bannock and Lewis Counties. Output, which remained substantially the same as in 1958, was consumed chiefly for cement manufacture; other uses included sugar refining, paper manufacturing, metallurgical flux, and agricultural applications. Quartzite was produced in Bear Lake, Caribou, and Power Counties and was used as a flux in electric furnaces at elemental-phosphorus facilities. Production increased sharply over that in 1958. Production of stone was reported from 15 of 44 counties in the State.

Sulfuric Acid.—The Bunker Hill Co. continued to produce sulfuric acid at Kellogg (Shoshone County). In its 1959 annual report to shareholders, the company reported sales of 100,581 tons of acid, which was the highest tonnage produced for sale since the plant began operating in 1954. Sulfur dioxide gases generated in roasting zinc concentrates at the electrolytic-zinc plant were utilized in making the sulfuric acid.

J. R. Simplot Co. brought into production a 400-ton-a-day sulfuric acid plant adjacent to the company fertilizer facility west of Pocatello, Power County. Elemental sulfur recovered at natural-gas-processing plants in Wyoming and Montana was used as a raw material. Output of the plant was used largely by the company to manufacture phosphate fertilizers and wet-process phosphoric acid.

REVIEW BY COUNTIES

Ada.—J. R. Simplot Co. acquired the sand separation plant of Baumhoff-Marshall, Inc. The plant was used from 1951 to 1955 to separate monazite, ilmenite, and garnet from dredge concentrate produced from deposits near Cascade, Valley County. Simplot continued the reprocessing of stockpiled ilmenite to obtain monazite, garnet, and a clean ilmenite concentrate.

Output of sand and gravel advanced 24 percent, a direct result of increased road-gravel requirements at State highway department projects. Pullman Brick Co. produced miscellaneous clay for making heavy-clay products at a pit near Boise. Production was moderately higher than in 1958.

Bannock.—Production of portland and masonry cement was continued at the Inkom plant of Idaho Portland Cement Co. utilizing limestone from the nearby company-operated Inkom quarry. Humus peat was produced near Downey. Production of sand and gravel was more than double the 1958 output, owing to increased use of road gravel by State highway department projects.

Bear Lake.—Mining and processing of phosphate rock increased fourfold over 1958. Central Farmers Fertilizer Co. mined phosphate rock at a greatly increased rate at the Georgetown Canyon mine. The rock was used to manufacture elemental phosphorus, phosphate fertilizers, phosphoric acid, and a beneficiated phosphate rock product. No phosphate rock was produced from the Waterloo mine of San Francisco Chemical Co.; however, a shipment was made from stocks at the mine early in the year. Quartzite for electric-furnace flux (elemental phosphorus) was produced at a quarry near Georgetown. Sand and gravel output remained substantially the same as in 1958.

TABLE 12.—Value of mineral production in Idaho, by counties

County	1958 (thousands)	1959 (thousands)	Minerals produced in 1959 in order of value
Ada	$611	$613	Sand and gravel, clays, gold.
Adams	(1)	22	Sand and gravel.
Bannock	(1)	(1)	Cement, sand and gravel, stone, peat.
Bear Lake	133	(1)	Phosphate rock, sand and gravel, stone.
Benewah	(1)	(1)	Garnet, gold.
Bingham	(1)	(1)	Phosphate rock, sand and gravel.
Blaine	289	257	Barite, sand and gravel, lead, zinc, stone, silver, copper, gold.
Boise	34	2	Silver, gold.
Bonner	(1)	101	Sand and gravel, silver, lead, gold.
Bonneville	735	534	Sand and gravel, pumice, stone, clays.
Boundary	57	171	Sand and gravel, stone, silver.
Butte	(1)	14	Sand and gravel.
Camas	192	----------	
Canyon	170	263	Sand and gravel, pumice.
Caribou	(1)	(1)	Phosphate rock, stone.
Cassia	295	598	Sand and gravel, clays.
Clark	(1)	79	Sand and gravel.
Clearwater	10	(1)	Gold, silver.
Custer	568	436	Lead, silver, sand and gravel, uranium, copper, zinc, gold.
Elmore	689	520	Sand and gravel, gold, silver.
Franklin	174	152	Sand and gravel.
Fremont	65	(1)	Do.
Gem	44	12	Gold, silver, lead, zinc.
Gooding	113	201	Sand and gravel.
Idaho	399	395	Sand and gravel, stone, gold, silver.
Jefferson	91	312	Sand and gravel.
Jerome	294	8	Sand and gravel, gold.
Kootenai	163	574	Sand and gravel, stone.
Latah	495	(1)	Clays, stone, mica.
Lemhi	6,738	4,449	Copper, cobalt, gold, sand and gravel, nickel, silver, lead, zinc, rare-earth-metals concentrate, stone.
Lewis	(1)	(1)	Stone.
Lincoln	(1)	33	Sand and gravel.
Madison	106	160	Sand and gravel, stone.
Minidoka	(1)	70	Sand and gravel, stone, clays.
Nez Perce	37	26	Sand and gravel.
Oneida	----------	4	Do.
Owyhee	8	41	Sand and gravel, clays, gold, silver.
Payette	----------	106	Sand and gravel.
Power	351	1,880	Sand and gravel, stone.
Shoshone	38,973	44,341	Silver, lead, zinc, copper, antimony, gold, sand and gravel, garnet.
Teton	(1)	98	Sand and gravel.
Twin Falls	274	356	Sand and gravel, stone, pumice.
Valley	1,222	641	Columbium-tantalum, rare-earth-metals concentrate, mercury, titanium (ilmenite), garnet, gold.
Washington	1,056	484	Mercury, iron ore, gypsum, sand and gravel.
Undistributed [2]	10,262	12,256	
Total [3]	64,648	70,209	

[1] Figure withheld to avoid disclosing company confidential data; included with "Undistributed."

[2] Includes the value of sand and gravel, stone, and gem stones that cannot be assigned to specific counties and values of minerals for counties indicated by footnote 1 (Adjusted to eliminate duplicating the value of stone).

[3] 1958 total revised; owing to rounding, individual items may not add to total shown.

Bingham.—Mining of phosphate rock at the Gay mine (J. R. Simplot Co.) near Fort Hall continued as the principal mineral-industry activity in the county. Production of both phosphate rock and phosphatic shale was larger than in 1958. The phosphate rock was used by the Simplot company to manufacture phosphate fertilizers and wet-process phosphoric acid at its plant west of Pocatello, Power County. Phosphatic shale was marketed for manufacturing elemental phosphorus.

Blaine.—Greater output of lead-zinc ore was reported for the Silver-Star Queens mine, one of the larger base-metal operations outside Shoshone County. The firm extended its workings at the underground mine by 180 feet of drifts, 265 feet of raises, and 20 feet of winzes. Crude-ore output was over 1,400 tons. Control of Silver-Star Queens Mines, Inc., was acquired in October by Samson Oil & Mineral Co., a Texas firm, through stock purchases.

Mining of barite was resumed at the Sun Valley mine (J. R. Simplot Co.), near Hailey. Crude barite was shipped to the company plant west of Pocatello, Power County, for grinding.

Bonner.—Silver ore was received at the Tacoma, Wash., smelter from the Weber mine (Austin-Meyer Corp.); production credited to the property was much less than in 1958. At the Conjecture silver mine, Federal Uranium Corp. completed early in the year the 1,000-foot shaft begun in 1958, and exploratory drifting and diamond drilling were begun on several levels. The work, done under a cooperative arrangement with Conjecture Mines, Inc., was stated to have proven a substantial quantity of good ore, and in December plans were announced to deepen the mine shaft to 1,400 feet.

Bonneville.—The county continued as the major pumice-producing area in the State, although production was less than in 1958. Pumice for use as lightweight aggregate was produced at three operations, all near Idaho Falls. Sand and gravel output dropped sharply, owing to reduced road-gravel requirements of the State highway department. Clay for use in manufacturing building brick was produced near Idaho Falls.

Caribou.—Mine production of crude phosphate rock rose sharply compared with 1958, largely owing to increased output at the Ballard operations of Monsanto Chemical Co. Output from the Ballard mine was reduced to elemental phosphorus at the company's electric-furnace plant near Soda Springs. During the year the company began hauling phosphate rock over a newly constructed private road connecting the elemental phosphorus plant with the mine—a distance of 11 miles. In April, J. R. Simplot Co., under contract, assumed operation of the Conda phosphate mine, formerly operated by The Anaconda Co. Production was used to supply fertilizer plants of both J. R. Simplot Co. (Pocatello) and The Anaconda Co. (Anaconda, Mont.).

Custer.—Several firms were exploring and developing uranium deposits in the county. Vitro Minerals Corp., affiliated with a processor of uranium ores at Salt Lake City (Vitro Uranium Co.), joined with Western Fluorite Mining Co. in forming Vitro Idaho Minerals Corp., which was to develop properties of the Western Fluorite firm near Stanley. Other companies which had engaged in work in the county included Rare Metals Corporation of America, Sidney Mining Co., and Phillips Petroleum Co. Clayton Silver Mines reported that mining and milling at the Clayton mine were resumed January 20 after being suspended in September 1958 owing to low base-metal prices. The firm milled 27,299 tons of ore during the year and completed 1,607 feet of drifting, raising, and crosscutting. According to the firm, a disastrous earthquake near Yellowstone National Park in mid-August severely jolted the Clayton mine area. Water flow in the underground workings increased sharply, and installed pumps were unable to keep up with the flow; two additional four-stage pumps were required. Mackay Exploration Co. produced 593 tons of copper ore at the Empire mine.

Idaho.—The county continued as the source of most of the placer gold recovered in the State. As in 1958, the Gold Bar placer (Del Dewey) was the largest placer in the county. However, production from the property was substantially less than in 1958.

Latah.—Mica was produced from two operations near Deary. Hand-cobbed ruby muscovite mica was produced from workings of Western Mica Corp., and a small quantity of hand-cobbed mica was produced from the Olsen property. The product was sold to GSA for stockpiling. Fire clay mined near Helmer was used to manufacture refractories at the Troy plant of A. P. Green Firebrick Co. Output of fire clay was substantially the same as in 1958. J. R. Simplot Co. began constructing a clay-processing plant on a 100-acre site west of Bovill.

Lemhi.—Calera Mining Co. stopped recovering cobalt concentrate at the Blackbird mine and mill in June. Only copper, gold, and silver in low-grade ore from the open pit were extracted for the remainder of the year. Milling rate was increased from the usual 1,000 tons a day to as high as 2,300 tons because of the lower grade of the mill feed. The company produced 17,521 tons of copper concentrate and 3,339 tons of cobalt concentrate from 378,569 tons of ore. Most of the ore (258,127 tons) treated during the last half of the year was low-grade material that had been stockpiled during earlier development of the open pit. The rest of the ore was from the open pit (112,325 tons) and from underground workings (6,907 tons). Exploration at the property comprised 3,304 feet of diamond drilling by a contractor, 4,000 feet of trenching, and a small amount of underground work. Employment at the mine and mill dropped from about 450 to 50 persons. Operations at the property were begun in June 1951 after several years of exploration and development. Activity was continued by several companies at thorite occurrences near Salmon. Some ore was milled for test purposes.

Power.—Processing of phosphate rock continued at two plants west of Pocatello. Phosphatic shale mined near Fort Hall, Bingham County, was reduced to elemental phosphorus by Westvaco Mineral Products Division, Food Machinery & Chemical Corp. J. R. Simplot Co. utilized phosphate rock from company-operated mines at Fort Hall, Bingham County, and Conda, Caribou County, to produce phosphate fertilizers and wet-process phosphoric acid. The Simplot company completed an expansion program begun at the Pocatello fertilizer plant in 1958. Included were additions to the fertilizer-processing and storage facilities and construction of a new sulfuric acid plant.

Quartzite quarried near Pocatello was used as a flux in electric-furnace manufacture of elemental phosphorus. The county was the leading sand-and-gravel-producing area in the State, owing to greatly increased road-gravel requirements by the State highway department.

Shoshone.—Value of minerals produced in the county increased 14 percent as base-metal production responded to improved markets and prices during the year. The output of silver, lead, zinc, copper, and gold (in order of value) from mines in the Coeur d'Alene region comprised over 99 percent of the total value of mineral commodities from the county and 63 percent of the value of mineral production in the State.

The many Bunker Hill Co. operations in the county were active without interruption throughout the year, although the threat of a strike persisted after expiration of the company's contract with the International Union of Mine, Mill, and Smelter Workers on June 30. A series of short-term extensions lasting through the remainder of the year averted closure of the Bunker Hill mining, milling, smelting, and refining facilities, also that of the mines and mills of other companies in the county.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, in terms of recoverable metals

Year	Mines producing		Material sold or treated (thousand short tons)	Gold, lode and placer (troy ounces)	Silver, lode and placer (thousand troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
	Lode	Placer							
1950-54 (average)	52	1	2,136	2,600	14,197	2,060	73,459	71,759	$56,264
1955	41	----------	1,637	1,777	12,984	2,637	59,820	50,527	44,037
1956	36	2	1,675	1,963	12.663	2,889	60,221	46,738	45,701
1957	31	----------	1,701	2,254	14,398	3,473	67,125	54,825	47,117
1958	25	----------	1,337	2,363	15,615	3,884	52,488	49,532	38,645
1959	17	1	1,422	2,349	16,461	3,678	61,155	55,454	44,058
1884-1959	----------	----------	(1)	425,000	604,372	96,000	6,430,000	2,050,000	1,785,899

[1] Complete data not available: 1904-1959, 104,091,000 short tons.

A major development was the construction of a phosphoric acid plant by Bunker Hill begun in September. The facility, which was about one-third complete by yearend, was being built to produce phosphoric acid by treating phosphate rock (shipped into the State) with sulfuric acid produced by the company from its waste smelter gases. The company sulfuric acid plant operated at capacity throughout the year.

The Bunker Hill lead smelter operated at about 80 percent of capacity, processing domestic and foreign ores and concentrates. Output was 94,084 tons of lead, a few tons more than in 1958. Fuming of the smelter slag yielded the second highest output of crude zinc oxide in the plant's history, despite the reduced smelting rate. According to the company's annual report to stockholders, sales of zinc in fume were 19,969 tons, compared with 17,460 tons in 1958. The Bunker Hill electrolytic-zinc plant also operated at about 80 percent of capacity (four electrolytic units) the first 11 months of the year, but in December the fifth electrolytic unit was placed in operation as a result of increased demand. Production for the year was 61,191 tons of zinc, compared with 55,454 tons in 1958.

Beaver District.—Two mines owned by Day Mines, Inc., were worked by lessees; production was 16,468 tons of zinc-lead-silver milling ore, according to the company annual report.

Evolution District.—Sunshine Mining Co. reported that a slightly larger quantity of higher grade ore was produced in 1959 than in 1958, with costs remaining constant. Output was 234,548 tons of ore averaging 27.57 ounces of silver a ton with additional values in lead, copper, and antimony. Most (89 percent) of the tonnage came from the unit operation begun by the company in 1958; part of the company property and adjacent holdings of other companies were worked as a unit to lower costs and increase efficiency. In its annual report to stockholders, Sunshine reported that mining costs were $12.70 per ton and that milling, leaching, and refining costs were $2.22 per ton. The company completed 9,135 feet of drifting, raising, and crosscutting, also 7,650 feet of diamond drilling. Preliminary work was begun on a new development shaft in the eastern part of the mine; the shaft was to reach the 4,300-foot level, which would be deeper than any other workings in the Coeur d'Alene district.

The Hecla Mining Co. annual report gave production at the Silver Summit mine as 29,422 tons assaying 32.28 ounces of silver a ton; although this tonnage was substantially below that in 1958, the ore assayed about 6 ounces more silver a ton. An agreement to mill ore from The Bunker Hill Co.'s Crescent mine at the Polaris mill of Hecla was announced; the purpose was to keep the mill in operation as tonnages of ore available from the Silver Summit mine decreased.

Hunter District.—The Star mine, owned by The Bunker Hill Co. and operated by Hecla Mining Co., was worked throughout the year on a 5-day-week basis. Total tonnage of ore milled (218,239) was the highest since 1953; metal recovery included 8,953 tons of lead, 21,221 tons of zinc, and 275,429 ounces of silver, according to the Bunker Hill annual report. Sand-fill mining was begun at the mine during the year and resulted in benefits both in mining cost and grade of ore.

Lucky Friday mine output again increased considerably over 1958. Ore production was 75,333 tons, and 69,428 tons was milled (55,176 tons in 1958 and 39,893 tons in 1957). Ore reserves increased 72 percent to an estimated 1,373,000 tons. Lucky-Friday Silver-Lead Mines Co. reported that 1,980 tons of lead concentrate and 1,045 tons of zinc concentrate were produced, which contained 56,956 ounces of silver, 2.5 million pounds of lead, and 1.2 million pounds of zinc. As in the past, ore was milled at the Golconda Lead Mines concentrator; however, at the end of the year a new 500-ton mill being built by the Lucky Friday company was nearing completion.

No production was reported for the old Morning mine (American Smelting and Refining Co.) in 1959. The mine was shut down in October 1953, and production from the property after that date was limited to that resulting from salvage of shaft pillars.

Lelande District.—According to the annual report of Day Mines, Inc., extraction of the Hercules far-west ore body was completed in August, and pumps on the 1,600-foot level were removed in September along with other salvageable equipment. After October, work was confined to removal of a remnant of ore on the 1,000-foot level (the last known ore in the mine). It was planned to allow subsequent flooding of all workings below the Burke operating level. The Hercules mine became one of the richest in the Coeur d'Alene area after its discovery in 1900; however, by 1925 it had been developed to the 1,000-foot level and appeared to have been worked out. In 1947 the mine was unwatered and reopened by Day Mines, Inc., and a new ore body discovered.

Placer Center District.—The Galena mine, leased by American Smelting and Refining Co. (75-percent interest) and Day Mines, Inc. (25-percent interest) from Callahan Mining Corp., continued as the second-largest silver-producing mine in the State. The Galena main shaft was deepened to the 4,000-foot level, and a new main ventilation shaft was begun; the latter was necessary because the rock temperatures increased at the deeper working levels. A new silver-copper-siderite ore vein, discovered early in November, was considered to be promising.

Lead-concentrate production from ore from the Dayrock mine of Day Mines, Inc., was continued. The firm reported discovery of a new silver-lead ore vein on the 1,100-foot level late in December.

Yreka District.—The Bunker Hill Co. ore output from the Bunker Hill mine increased about 25 percent over 1958. The company annual report listed recovery of 32,792 tons of lead, 11,676 tons of zinc, and 1,992,991 ounces of silver from 445,369 dry tons of ore milled. Ore reserves at the end of the year were slightly less than at yearend 1958 but exceeded the average of the preceding 10 years. Development continued at the company Crescent mine, and stoping was begun on three ore shoots. These operations yielded 24,934 tons of ore containing 503,074 ounces of silver, an increase of 155,238 ounces over 1958.

Ore production at the Page mine (American Smelting and Refining Co.), source of a large share of the county lead and zinc output, was slightly less than in 1958. The company began a 4-day workweek at the end of April, and the schedule continued until the end of August.

Sidney Mining Co. obtained 902 tons of lead concentrate and 1,345 tons of zinc concentrate from 7,220 tons of ore from its Sidney mine. This output contrasted with the 27,400 tons of ore milled in 1958. The firm had reported that it was unable to locate additional ore reserves in the mine and that the remaining reserve was small. The Sidney company entered into an agreement with Nabob Silver-Lead Co. to develop and mine the Nabob on a profit-sharing basis; low metal prices had forced closure of the Nabob property in mid-1957 at a time when a newly discovered ore shoot had been only partly developed. Production by Sidney from the Nabob mine, which was begun early in March after unwatering the mine and making repairs, was 8,950 tons, from which 829 tons of lead concentrate and 1,811 tons of zinc were obtained.

Valley.—Shipment in 1959 of 723,583 pounds of euxenite concentrate containing 189,263 pounds of columbium-tantalum oxides by Porter Bros. Corp. sufficed to fill the company contract with the Government for a total of 1,050,000 pounds of the pentoxides, and the operation was discontinued in October. Dredging in Bear Valley and milling at Lowman were begun by the firm in 1955. Garnet sand, recovered as a byproduct, was sold to a local processor for drying, sizing, bagging, and resale. The company also recovered monazite concentrate and shipped some to eastern processors.

The Hermes mercury mine (Holly Minerals Corp.) yielded only 225 flasks of mercury during the year compared with 490 in 1958. Flotation concentrate prepared from crude ore was retorted; no mercury was produced by the electrolytic process used to recover 239 flasks in 1958.

Washington.—The Iron Mountain mine near Weiser, operated by Shasta Mining Co. until October, was the only source of iron ore in the State in 1959. Rare Metals Corporation of America operated the Idaho-Almaden mercury mine at a slightly reduced rate. Exploration and development by the firm included 745 drill holes totaling 23,344 feet; in addition, 12,630 tons of waste was stripped at the open pit.

The Mineral Industry of Illinois

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MINERAL output in Illinois in 1959 established a new record of $577.4 million, a slight increase over the previous high of $576.9 million (revised) in 1958. Increases in production of portland and masonry cements, coal, lead, lime, sand and gravel, stone, tripoli, and zinc offset declines in output of other minerals.

TABLE 1.—Mineral production in Illinois[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland ... thousand 376-pound barrels	9,205	$29,308	9,486	$30,158
Masonry ... do	413	1,551	439	1,636
Clays ... thousand short tons	2,335	5,910	2,229	4,950
Coal[2] ... do	43,912	176,614	45,466	184,412
Fluorspar	152,087	7,931	112,469	5,908
Gem stones	(3)	1	(3)	1
Lead (recoverable content of ores, etc.)	1,610	377	2,570	591
Natural gas ... million cubic feet	12,983	1,921	[4] 12,500	[4] 1,900
Natural-gas liquids:				
Natural gasoline and cycle products thousand gallons	22,380	1,645	(5)	(5)
LP-gases ... do	353,129	20,866	(5)	(5)
Peat	11,588	72	9,117	72
Petroleum (crude) ... thousand 42-gallon barrels	80,275	240,825	[4] 78,435	[4] 234,521
Sand and gravel ... thousand short tons	29,866	33,453	30,241	33,717
Stone ... do	35,016	44,245	35,294	45,081
Zinc (recoverable content of ores, etc.)	24,940	5,088	26,815	6,167
Value of items that cannot be disclosed: Lime, tripoli, and values indicated by footnote 5		9,573		30,897
Total Illinois[6]		[7] 576,862		577,372

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Exclusive of mines producing less than 1,000 net tons.
[3] Weight not recorded.
[4] Preliminary figure.
[5] Figure withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed."
[6] Total adjusted to eliminate duplicating value of clays and stone.
[7] Revised figure.

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notably clays, fluorspar, natural gas liquids, and petroleum. Mineral fuels comprised 77 percent of the total value of State mineral production in 1959, nonmetals supplied 22 percent, and metals the remainder.

Illinois continued to rank high among the States in mineral production. In 1959 the State led the Nation in output of fluorspar, was fourth in stone and bituminous coal, and sixth in sand and gravel. Illinois also ranked high as a center for processing mineral raw materials, including those produced outside its borders. Excellent transportation facilities have been the chief factor in establishing a wide variety of manufacturing industries in the State.

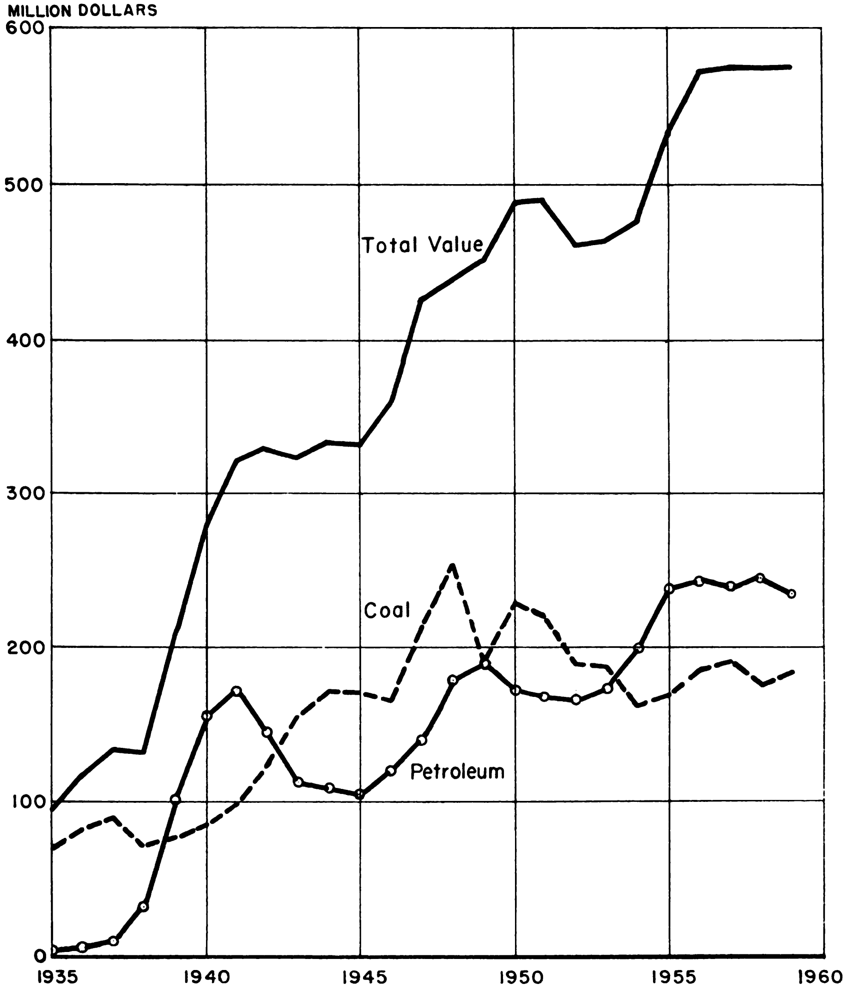

FIGURE 1.—Value of coal, petroleum, and total value of mineral production in Illinois, 1935–59.

TABLE 2.—Average unit values of selected mineral commodities produced in Illinois

Mineral		1955	1956	1957	1958	1959
Cement:						
Portland	376-pound barrel	$2.64	$2.88	$3.03	$3.18	$3.18
Masonry	do	2.89	3.57	3.76	3.75	3.73
Clays:						
Fire	short tons	2.06	1.97	5.36	3.77	6.71
Miscellaneous	do	1.64	1.73	1.90	1.97	1.46
Coal:						
Underground	do	3.87	3.84	4.02	4.09	4.10
Strip and auger [1]	do	3.37	3.84	3.97	3.94	4.01
Fluorspar	do	47.12	47.51	51.94	52.15	52.53
Limestone:						
Dimension [2]	cubic foot	.90	1.15	2.16	4.11	4.36
Crushed and broken	short ton	1.23	1.28	1.31	1.26	1.27
Natural gas	thousand cubic feet	.129	.151	.155	.148	.152
Peat	short ton	(3)	10.90	9.26	6.26	7.85
Petroleum	42-gallon barrel	2.91	2.93	3.12	3.00	[4] 2.99
Sand and gravel:						
Sand	short ton	1.40	1.38	1.41	1.41	1.41
Gravel	do	.79	.79	.81	.92	.88

[1] No auger mine production 1955–57.
[2] Excludes dimension limestone used for rough construction and rubble
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.

Employment and Injuries.—Approximately 37.4 million man-hours was worked in Illinois mineral industries in 1959, excluding officeworkers and employees of the entire petroleum industry. This was a slight decrease from the final figure of 37.5 million man-hours recorded for 1958.

TABLE 3.—Summary of employment and injuries for selected mineral industries in Illinois [1]

Year and commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1958							
Cement [4]	966	2,451,621	3	4	(5)	2.86	(5)
Clays [6]	823	1,346,720	1	47	7,736	35.64	5,744
Coal	10,905	17,761,835	10	710	109,259	40.54	6,151
Coke ovens	768	1,797,721	--------	14	(5)	7.79	(5)
Fluorspar	630	1,136,492	1	39	8,889	35.20	7,821
Limestone [7]	2,640	5,107,208	2	111	(5)	22.13	(5)
Sand and gravel	2,088	3,885,368	1	76	7,477	19.82	1,924
Smelters	1,313	3,263,220	--------	53	3,162	16.24	969
1959							
Cement [4]	913	2,389,359	--------	4	(5)	1.67	(5)
Clays [6]	1,171	2,054,020	1	51	8,380	25.31	4,080
Coal	10,499	17,683,051	9	719	84,348	41.17	4,770
Coke ovens	673	1,854,854	--------	10	(5)	5.39	(5)
Fluorspar	472	849,410	--------	23	5,715	27.08	6,728
Limestone [7]	2,479	5,023,169	1	122	(5)	24.49	(5)
Sand and gravel	1,691	3,520,421	--------	53	1,792	15.06	509
Smelters	1,333	3,171,689	--------	36	920	11.35	290

[1] Data exclude officeworkers; are final for 1958 and preliminary for 1959.
[2] Total number of injuries per million man-hours.
[3] Total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used exclusively in manufacturing cement.
[7] Excludes quarries producing limestone used exclusively in manufacturing cement and lime.

A total of 11 fatal and 1,035 nonfatal disabling injuries was recorded for the State mineral industries in 1959, compared with 18 fatal and 1,066 nonfatal injuries the previous year. Table 3 contains a summary of employment and injury statistics for selected State mineral industries. Certain industries are excluded from the table to avoid disclosing individual company confidential data.

For the fifth consecutive year, the Lockport plant of Material Service Corp. won the top award for bank or pit operations in the Bureau of Mines Sand and Gravel Safety Competition. In 1959 the plant worked 204,081 man-hours without sustaining a disabling work injury. Other mineral operations in the State experienced injury-free records in 1959, although not winning top honors in their respective groups of National Safety Competitions.

Legislation and Government Programs.—A contract between the Office of Minerals Exploration (OME) and the New Jersey Zinc Co. covering fluorspar exploration in Pope County was in effect during part of 1959. Work on the contract was begun July 1958 and completed May 1959 with a certificate of discovery issued. The Government advanced 50 percent of approved costs of the project, amounting to nearly $18,000.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Illinois maintained its rank as fourth largest coal-producing State in the Nation with an output of 45.5 million tons. Chief reason for a 4-percent rise in output over 1958 was a 1.5-million-ton increase in consumption of coal by electric power utilities; over 24 million tons of coal mined in the State in 1959 was used for production of electrical energy. Other markets for Illinois coal included general manufacturing and processing industries in the Midwest, domestic consumers, coke and gas plants, and railroads. Chiefly because of the 116-day strike in the steel industry, Illinois coal produced for use in coke and gas plants declined to 696,000-tons, a 5-percent decrease from 1958. Over 500,000 tons was sold for railroad fuel, a steadily declining use, compared with about 750,000 tons in 1958. Nearly 67 percent of the bituminous coal consumed in Illinois in 1959 was mined in the State. Average mine value was $4.08 per ton, compared with $4.02 in 1958.

Coal was produced from 137 mines in 36 counties. Over one million tons was produced in each of the following counties, listed in order of rank: Williamson, St. Clair, Fulton, Franklin, Christian, Perry, Jefferson, Saline, Knox, Montgomery, Jackson, and Vermilion. Eleven companies each produced over one million tons and together furnished 80 percent of the State's total output. The Peabody Coal Co.'s No. 10 underground mine in Christian County was the largest producing bituminous-coal mine in the United States in 1959, with an output of 3,764,000 tons.

Underground mines supplied 52 percent of the total production; strip and auger mines the remainder. Output from underground and strip mines increased 1 and 7 percent, respectively, over 1958.

TABLE 4.—Bituminous-coal production, value, and number of mines operated in 1959, by counties

(Exclusive of mines producing less than 1,000 net tons)

County	Production (short tons)			Total value	Number of mines operated		
	Underground	Strip and Auger [1]	Total		Underground	Strip	Auger
Adams	----------	37,087	37,087	$163,925	-------	1	-------
Brown	----------	1,482	1,482	6,550	-------	1	-------
Bureau	----------	(2)	(2)	(2)	-------	1	-------
Christian	3,764,147	----------	3,764,147	(2)	1	-------	-------
Clinton	43,008	----------	43,008	191,321	2	-------	-------
Douglas	482,355	----------	482,355	2,159,511	1	-------	-------
Franklin	4,609,972	----------	4,609,972	(2)	4	-------	-------
Fulton	25,011	5,087,610	5,112,621	21,373,444	3	12	-------
Gallatin	54,149	(2)	(2)	(2)	2	3	1
Greene	----------	7,433	7,433	37,165	-------	1	-------
Henry	92,209	----------	92,209	413,642	2	-------	-------
Jackson	637,839	608,108	1,245,947	5,142,272	2	2	-------
Jefferson	3,111,124	23,180	3,134,304	(2)	1	1	-------
Kankakee	----------	73,463	73,463	(2)	-------	1	-------
Knox	----------	2,196,359	2,196,359	9,155,848	-------	4	-------
La Salle	----------	6,756	6,756	30,605	-------	1	-------
Livingston	----------	1,181	1,181	10,629	-------	1	-------
Logan	24,611	----------	24,611	163,460	1	-------	-------
Macoupin	375,175	----------	375,175	1,577,488	2	-------	-------
Madison	610,892	----------	610,892	2,646,168	2	-------	-------
Marion	18,263	----------	18,263	84,281	1	-------	-------
Menard	13,228	----------	13,228	80,768	2	-------	-------
Mercer	29,713	(2)	(2)	(2)	1	1	-------
Montgomery	1,625,192	----------	1,625,192	(2)	1	-------	-------
Peoria	24,603	299,904	324,507	1,654,029	3	5	-------
Perry	3,665	3,506,532	3,510,197	12,132,382	1	5	-------
Randolph	736,068	186,954	923,022	3,193,541	1	2	-------
St. Clair	2,141,573	3,127,527	5,269,100	(2)	5	4	-------
Saline	1,152,678	1,416,948	2,569,626	10,714,958	2	6	1
Sangamon	103,247	----------	103,247	(2)	2	-------	-------
Schuyler	6,094	749,235	755,329	(2)	1	1	-------
Vermilion	63,274	1,153,522	1,216,796	5,470,973	4	5	-------
Wabash	----------	1,317	1,317	6,585	-------	1	-------
Washington	25,181	----------	25,181	125,164	2	-------	-------
Will	----------	461,678	461,678	(2)	-------	1	-------
Williamson	3,753,146	2,388,821	6,141,967	25,029,116	15	11	-------
Undistributed	----------	604,102	687,964	82,848,123	-------	-------	-------
Total	23,526,417	21,939,199	45,465,616	184,411,948	64	71	2

[1] Strip and auger production combined in order to avoid disclosing individual company confidential data

[2] Included with "Undistributed" to avoid disclosing individual company confidential data.

Over 99 percent of total State production was cleaned at 58 plants. Virtually the entire underground production was cut by machines; over 99 percent was loaded mechanically, utilizing 39 continuous-mining machines, 126 mobile loaders, and 11 duckbills or self-loading conveyors. Approximately 88 percent of the total output was shipped to consumers by rail or waterways and most of the remainder by truck.

Freeman Coal Mining Corp. began developing its new Orient No. 5 underground mine near Benton; Old Ben Coal Corp. continued developing its No. 21 underground mine near Sesser; and the Stonefort Corp. began developing a new strip mine near Wyoming. Production from these mines was expected in 1960. Late in 1959 production was begun at the new Banner No. 27 strip mine of The United Electric Coal Companies near Glasford; the mine was expected to be in full operation in the spring of 1960. Truax-Traer Coal Co. abandoned its Pyramid strip mine near Pinckneyville in September.

Coke.—Despite the lengthy steel strike, approximately 2,045,000 short tons of coke valued at $37.8 million was produced at six plants in Illinois in 1959, compared with 1,911,000 tons valued at $37.4 million in 1958. Over 1.9 million tons was used by producing companies in blast furnaces. About 147,000 tons of coke breeze valued at $853,000 was recovered at Illinois coke plants in 1959 and most of it was used by producers in steam and agglomerating plants. Other products of coke-oven plants included coke-oven gas, ammonia, tar, and light oil.

Peat.—Peat was produced by four companies from bogs in Cook, Kane, and Lake Counties. Output decreased 21 percent in quantity but only slightly in total value from 1958. The entire output was used for soil conditioning. About 85 percent was sold in bulk, and the remainder was packaged.

Petroleum, Natural Gas, and Natural-Gas Liquids.—Crude petroleum comprised 41 percent of the total value of State mineral production. Output decreased 2 percent in quantity and 3 percent in value, compared with 1958. Production was mostly from wells in the southeastern part of the State. According to the Illinois State Geological Survey, of the 2,032 wells completed in 1959, 964 were producing oil wells, 17 were gas, 564 were dry holes in pools, and 487 were unsuccessful wildcats. Total footage drilled was 4,458,906, of which 50 percent was in producing wells. The State Geological Survey published the third in a series of three reports on theory of hydraulic fracture.[2]

Marketed natural gas decreased 4 percent in quantity and 1 percent in value from 1958. Total output of natural-gas liquids decreased 3 percent in quantity and 6 percent in value from 1958.

TABLE 5.—Production of crude petroleum, by fields, in thousand barrels

[Oil and Gas Journal]

Field	1955	1956	1957	1958	1959[1]
Albion	1,232	1,120	1,313	1,377	1,113
Benton	1,462	1,032	807	606	529
Boyd	718	899	952	668	485
Bridgeport	3,417	4,352	4,174	5,280	6,264
Centralia	563	546	2,076	3,480	2,160
Clay City	10,300	9,210	8,187	7,972	7,269
Dale	1,912	3,543	2,441	2,485	1,979
East Inman	1,067	1,513	1,415	1,537	1,126
Johnsonville	839	1,063	1,010	992	1,698
Louden	7,535	9,828	11,691	13,158	12,586
New Harmony	4,440	4,022	3,462	4,430	4,758
Phillipstown	979	1,168	547	691	606
Robinson	2,606	2,621	2,752	2,755	3,197
Roland	2,045	2,503	2,449	2,155	1,860
Sailor Springs	1,544	1,794	1,552	1,531	1,378
Salem	7,673	6,606	5,644	6,475	6,926
Other fields[2]	33,091	30,526	26,611	24,683	24,501
Total Illinois	81,423	82,346	77,083	80,275	78,435

[1] Preliminary figures.
[2] Bureau of Mines figures.

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[2] Cleary, J. M., Hydraulic Fracture Theory, Part 3, Elastic Properties of Sandstone: Illinois State Geol. Survey Circ. 281, 1959, 44 pp.

NONMETALS

Cement.—Four companies produced portland and masonry cements at plants in La Salle and Lee Counties. Sales of portland cement increased 3 percent in quantity and value over 1958 and output of masonry cement increased 6 percent.

Portland-cement output consisted of types I and II (general use and moderate heat) and type III (high early strength). Nearly 87 percent of the portland cement and more than 53 percent of the masonry cement shipped from Illinois plants went to consumers within the State. Most of the remainder was shipped to neighboring States. Approximately 65 percent of the total portland-cement output was shipped to ready-mix-concrete companies, 13 percent to concrete-product manufacturers, 12 percent to highway contractors, 9 percent to building-material dealers, and the remainder to other consumers. All shipments were by rail—84 percent in bulk and 16 percent in paper bags.

Nearly 235 million kw.-hr. of electrical energy, most generated by two companies, was used at Illinois plants. Producing companies quarried over 2.6 million tons of limestone used in manufacturing portland cement. Other raw materials consumed included over 200,000 tons of clay and shale, 81,000 tons of gypsum, and lesser quantities of anhydrite, sand, iron ore, grinding aids, air-entraining compounds, and other materials. Annual finished portland-cement capacity of Illinois plants remained at nearly 10 million barrels.

Average mill value of portland cement was $3.18 per 376-pound barrel, the same as in 1958. Average value of masonry cement was $3.73 per barrel, compared with $3.75 in 1958.

TABLE 6.—Finished portland cement produced and shipped

Year	Active plants	Production barrels (thousands)	Shipped from mills	
			Barrels (thousands)	Value (thousands)
1950–54 (average)	4	8, 527	8, 541	$20, 497
1955	4	8, 810	8, 655	22, 886
1956	4	8, 823	8, 629	24, 866
1957	4	8, 794	8, 097	24, 560
1958	4	9, 433	9, 205	29, 308
1959	4	9, 559	9, 486	30, 158

Clays.—Total production of miscellaneous and fire clays decreased 5 percent in quantity and 16 percent in value from 1958. Chief reason for the decrease was the substantial decline in fire-clay production from that reported in 1958. Output of fire clay was reported by nine companies in Greene, Grundy, Knox, La Salle, Marshall, and Rock Island Counties. The material was used chiefly for refractory purposes and for manufacturing heavy clay products and art pottery.

Miscellaneous clay was produced in 21 counties and was used for manufacturing lightweight aggregate, cement, building brick, drain-tile, sewer pipe, pottery, and other uses. Output used in manufacturing lightweight aggregate increased 46 percent over 1958, chiefly because of the full-scale operation of Material Service Corp.'s new plant in La Salle County. Approximately 200,000 tons of miscellaneous clay and shale was produced for use in manufacturing cement.

Several reports concerning clay investigations conducted by the Illinois State Geological Survey were published.[3]

TABLE 7.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1950–54 (average)	411	$1,380	1,944	$2,489	2,356	$3,869
1955	363	748	1,975	3,231	2,339	3,979
1956	441	870	1,817	3,136	2,258	4,005
1957	438	2,345	1,479	2,810	1,917	5,155
1958	725	2,733	1,610	3,177	2,335	5,910
1959	322	2,158	1,908	2,792	2,229	4,950

Fluorspar.—Illinois continued to lead the Nation in production of fluorspar—61 percent of the total domestic output in 1959. However, production decreased 26 percent in quantity from 1958 to the lowest level since 1954. The marked decline was attributed chiefly to termination in 1958 of Government purchase programs sustaining domestic output and to a 42-percent increase in imports for consumption. A strike of glassmolders had an adverse effect on demand for Ceramic-grade fluorspar, and the lengthy steel strike was partly responsible for the drop in shipments of Metallurgical grade. Nearly 74 percent of the Illinois shipments was classified as Acid grade; 22 percent as Ceramic; and the remainder as Metallurgical.

Mills in Illinois processed 301,000 tons of crude ore, from which 111,000 tons of finished fluorspar was produced. Leading producers were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co. These companies also produced lead and/or zinc concentrates as byproducts of fluorspar mining. A fire in the crushing and screening department of Ozark-Mahoning Co.'s plant forced the mill to close for about 2 weeks in February. Slackened demand for fluorspar caused a 1-week shutdown of the Minerva Oil Co. mines and plant in September and forced drastic curtailment of operations toward the close of the year. Many of the smaller mines in the State were closed or operated at a reduced scale after the end of the Government purchase program. Crude material mined at several of these operations was shipped to other companies for processing. All finished fluorspar produced in the State in 1959 was credited to Hardin County, although a few thousand tons of crude ore was mined in Pope County.

Exploration in Pope County under contract between OME and the New Jersey Zinc Co. was completed in May, when a certificate of discovery was issued.

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[3] White, W. Arthur, and Pichler, Ernesto, Water Sorption Characteristics of Clay Minerals: Illinois State Geol. Surv. Circ. 266, 1959, 20 pp.; Parham, Walter E., Light-Burning Clay Resources in La Salle County, Illinois: Illinois State Geol. Surv. Circ. 277, 1959, 27 pp.; White, W. Arthur, Chemical and Spectrochemical Analyses of Illinois Clay Materials: Illinois State Geol. Surv. Circ. 282, 1959, 55 pp.

Gem Stones.—Fluorite specimens were collected by several individuals in Hardin County. The material was used principally for personal collections.

Lime.—Illinois was one of the leading lime-producing States in the Nation in 1959—eighth among 33 producing States. Lime was produced by three companies at five plants in Adams and Cook Counties. Total shipments of quick and hydrated limes increased about 5 percent in quantity and 2 percent in value over 1958. Nearly 61 percent of the total State output was for refractories, 33 percent for chemical and other industrial uses, and 6 percent for building.

Perlite.—Crude perlite mined in Western States was expanded at plants in Champaign, Cook, Lake, and Will Counties. Total sales of the expanded product decreased from 1958. About four-fifths of the total output was used as lightweight aggregate in plaster and concrete and the remainder for loose fill insulation, soil conditioning, filters, and other purposes. Late in 1959, the Johns-Manville Perlite Corp., acquired the Joliet plant of F. E. Schundler & Co., Inc.

Sand and Gravel.—Illinois ranked sixth in the Nation in quantity of sand and gravel produced in 1959. Production increased slightly over 1958. Consumption for paving increased nearly 1.9 million tons, but material for building declined 1.4 million tons, compared with 1958. Total output of industrial sands remained substantially the same as the previous year. Sand and gravel for railroad ballast decreased 14 percent from 1958. More than 58 percent of the total State output was for paving and nearly 27 percent for building. The remainder was used for glass manufacturing, molding, grinding and polishing, sandblasting, engine use, railroad ballast, filler, foundry use, enamel, pottery, and other purposes.

Nearly 79 percent of the total production was transported by truck, 20 percent by rail, and 1 percent by water.

Production was reported from 71 counties. Counties producing over 1 million tons were: Du Page, Grundy, Kane, Lake, La Salle, McHenry, Peoria, Tazewell, Will, and Winnebago. Major producers included Chicago Gravel Co., Consumers Co., Elmhurst-Chicago Stone Co., McGrath Sand & Gravel Co., Inc., Material Service Corp., Ottawa Silica Co., Portage-Manley Sand Co., C. A. Powley Co., Road Materials Corp., and Wedron Silica Co.

Stone.—A record in stone production was established in Illinois in 1959. The output was limestone except for a small quantity of sandstone. The new mark of 35.3 million tons surpassed the previous high set in 1958 by nearly 1 percent. The State ranked fourth in the Nation in stone output, exceeded only by Ohio, Pennsylvania, and Texas. Total value of production in the State increased 2 percent over 1958.

A 4-percent increase in consumption of crushed limestone for concrete aggregate and roadstone offset marked declines in use for railroad ballast and agriculture. Output for concrete aggregate and roadstone comprised more than 77 percent of the total State stone production. Quantities used for manufacturing cement and for asphalt filler increased over 1958. Additional uses for crushed limestone included riprap, chemical, metallurgical, lime, various fillers, and other purposes.

Production of limestone was reported from 60 counties. Counties producing over 1 million tons were: Cook, Kankakee, La Salle, Livingston, Randolph, St. Clair, Vermilion, and Will. Dimension limestone was produced for architecture and rubble in Du Page, Kane, McHenry, St. Clair, and Union Counties. Major producers of limestone included: Allied Chemical & Dye Corp., Anna Quarries, Inc., Columbia Quarry Co., Consumers Co., Dolese & Shepard Co., East St. Louis Stone Co., Elmhurst-Chicago Stone Co., Lehigh Stone Co., Material Service Corp., and Mississippi Lime Co. Sandstone was produced in Alexander and La Salle Counties.

Sulfur.—Byproduct sulfur was recovered by the Pure Oil Co. at its Lemont Refinery in Cook County and by The Anlin Company of Illinois at its new plant in Hartford, Madison County. Operation was begun at the latter plant in October.

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:[1]				
Glass	1,197	$2,904	1,216	$2,962
Molding	570	1,509	548	1,502
Building	4,937	4,698	4,615	4,435
Paving	4,040	3,480	5,215	5,101
Engine	75	133	73	127
Fill	441	245	677	377
Ground	171	1,683	197	1,845
Undistributed	583	2,457	583	2,487
Total[2]	12,014	17,108	13,124	18,836
Gravel:				
Building	4,487	4,556	3,419	3,531
Paving	10,206	9,360	9,690	9,093
Railroad ballast	537	352	304	221
Fill	455	307	936	546
Other	681	678	65	61
Total	16,366	15,253	14,414	13,452
Total sand and gravel	28,380	32,361	27,538	32,288
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	1	(3)	4	2
Paving	217	155	374	170
Total	218	156	378	172
Gravel:				
Building	44	25	27	11
Paving	1,223	911	2,298	1,246
Total	1,267	936	2,325	1,257
Total sand and gravel	1,486	1,092	2,703	1,429
ALL OPERATIONS				
Sand	12,232	17,264	13,502	19,008
Gravel	17,633	16,190	16,739	14,709
Grand total	29,866	33,453	30,241	33,717

[1] Includes friable sandstone.

[2] Includes fire or furnace (1958); blast, grinding and polishing, filter, railroad ballast (1958–59); and hydrafac (1959).

[3] Less than $1,000.

TABLE 9.—Limestone sold or used by producers, by uses

Use	1958		1959	
	Quantity (thousands)	Value (thousands)	Quantity (thousands)	Value (thousands)
Dimension:[1]				
Rubble, (and rough construction—1958) short tons	(2)	$2	1	$4
House-stone veneer, cut stone, and flagging cubic feet	25	104	39	171
Total dimension equivalent short tons[3]	3	106	4	175
Crushed and broken:				
Riprap short tons	266	357	246	329
Concrete aggregate and roadstone do	26, 315	33, 359	27, 257	34, 811
Railroad ballast do	504	705	201	243
Agriculture do	3, 371	4, 726	2, 758	3, 877
Asphalt do	330	840	369	899
Cement do	2, 613	1, 701	2, 631	1, 747
Other[4] do	1, 614	2, 442	1, 724	2, 805
Total crushed and broken do	35, 013	44, 130	35, 186	44, 711
Grand total do	35, 015	44, 236	35, 190	44, 886

[1] Uses as shown combined to avoid disclosing individual company confidential data.
[2] Less than 1,000 tons.
[3] Average weight of 170 pounds per cubic foot used to convert cubic feet to short tons.
[4] Limestone for chemical, filler, metallurgical, and other purposes combined to avoid disclosing individual company confidential data.

Tripoli.—Tripoli (amorphous silica) was mined and processed by two companies in northern Alexander County. Output of crude material increased 18 percent in quantity over 1958. Sales of prepared material increased 5 percent in quantity and value over 1958. Sales were for abrasive, filler, and other purposes.

Vermiculite.—Crude vermiculite mined in Montana and South Carolina was exfoliated at plants operated by two companies in Cook and Macoupin Counties. Output was used as insulating material, lightweight aggregate in plaster and concrete, and for other purposes. The plant of F. E. Schundler & Co., Inc., at Joliet was destroyed by fire in December 1958 and interests of the company were acquired late in 1959 by Johns-Manville Perlite Corp.

A new kind of vermiculite masonry fill for insulating block and cavity walls was announced.[4] A patented spraying process coats the granules with a waterproofing compound to make them water repellant. The treated material flows freely and can be quickly and easily poured into the cores of blocks.

METALS

Lead and Zinc.—Lead and zinc were produced as primary products from mines in Jo Daviess County (Northern Illinois district) and as byproducts of fluorspar mining in Hardin County (Southern Illinois district). In terms of recoverable metal, lead output increased 60 percent in quantity and 57 percent in value over 1958. Consumption of lead in the United States increased substantially. Imports of lead were curbed by quotas established in the fall of 1958, which remained in effect throughout 1959. Production of zinc in Illinois increased nearly 8 percent in quantity and about 21 percent in value over 1958.

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[4] Rock Products, VIC Reveals New Masonry Fill: Vol. 62, No. 6, June 1959, p. 116.

Zinc consumption in the Nation increased over 1958, despite the prolonged steel strike in the latter half of 1959, which adversely affected the use of zinc for galvanizing. Imports of zinc were restricted by quotas throughout 1959. Although imports of zinc in ores and concentrates increased over 1958, imports of slab zinc decreased about 20 percent.

In northern Illinois, Eagle-Picher Co. and Tri-State Zinc, Inc., operated their mines continuously throughout the year except for vacation periods in June and July. Hickory Hill Mining Co. made sporadic shipments. Some mining operations in southern Illinois were suspended or curtailed because of the depressed fluorspar market. However, lead and zinc output in that district increased over 1958 chiefly because of the higher average content of these metals in ore processed. Major producers in southern Illinois were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co.

Average weighted yearly prices used to calculate total values of lead and zinc production in 1959 were 11.5 cents per pound for lead and 11.5 cents per pound for zinc. Comparable prices for 1958 were 11.7 cents for lead and 10.2 cents for zinc. The quoted price of lead (New York) opened in 1959 at 13 cents per pound and changed 10 times during the year. It dropped to 11 cents by February 24, gained a half cent in March and declined to 11 cents

TABLE 10.—Mine production of silver, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Materials sold or treated[1] (short tons)	Silver		Lead		Zinc		Total value
			Troy ounces	Value	Short tons	Value	Short tons	Value	
1955	13	839,555	3,075	$2,783	4,544	$1,354,112	21,700	$5,338,200	$6,695,095
1956	23	851,285	1,580	1,430	3,832	1,203,248	24,039	6,586,686	7,791,364
1957	23	853,661	--------	--------	2,970	849,420	22,185	5,146,920	5,996,340
1958	19	1,003,020	--------	--------	1,610	376,740	24,940	5,087,760	5,464,500
1959	22	930,265	--------	--------	2,570	591,100	26,815	6,167,450	6,758,550

[1] Data include fluorspar ore from which lead and/or zinc was recovered as follows: 1955—309,311 tons; 1956—336,635 tons; 1957—360,406 tons; 1958—401,562 tons; and 1959—297,252 tons.

TABLE 11.—Mine production of lead and zinc in 1959, by months, in terms of recoverable metals, in short tons

Month	Northern Illinois		Southern Illinois		Total Illinois	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
January	150	1,690	110	585	260	2,275
February	200	1,740	80	320	280	2,060
March	120	1,770	145	695	265	2,465
April	65	1,490	35	445	100	1,935
May	65	1,505	35	400	100	1,905
June	185	1,405	80	740	265	2,145
July	75	1,465	60	695	135	2,160
August	60	1,760	65	580	125	2,340
September	90	1,620	165	765	255	2,385
October	120	1,745	150	665	270	2,410
November	120	1,670	145	640	265	2,310
December	120	1,755	130	670	250	2,425
Total	1,370	19,615	1,200	7,200	2,570	26,815

on April 1. The price increased to 12 cents in May and 13 cents in August. Two half-cent decreases in December brought the price to 12 cents, where it remained at the close of the year. Zinc market prices (East St. Louis) opened in 1959 at 11.5 cents per pound, declined to 11 cents February 25, and rose to 12 cents September 21. On October 20 several smelters increased the price to 13 cents, but other smelters raised it to only 12.5 cents. The price was established at 12.5 cents on November 2 and remained there until yearend.

Pig Iron and Steel.—In spite of the 116-day steel strike, output of pig iron and steel from Illinois plants increased over 1958. More than 5.3 million short tons of pig iron was produced in the State, a 26-percent increase over 1958. Value of output was approximately $320 million, a gain of 24 percent over 1958. Six companies operated blast furnaces at Chicago and Granite City. Youngstown Sheet & Tube Co. resumed operation at two of its three furnaces early in 1959. Only two companies—Granite City Steel Co. and Wisconsin Steel Division of International Harvester Co.—operated furnaces during the strike. Of the 22 blast furnaces in Illinois, 3 were not operated at all in 1959, and 17 were out of blast part of the year for an average of 145 days. According to the American Iron & Steel Institute, annual blast-furnace capacity in Illinois as of January 1, 1959, was 7,894,200 tons and increased to 7,955,200 by yearend. Granite City Steel Co. began constructing a new blast furnace at its Granite City works the latter part of 1959. Capacity of the new furnace, which was to replace the older of the company's two furnaces, was to be 1,800 tons/day of pig iron. Expected completion date was the summer of 1960. Interlake Iron Corp. announced plans to construct a sintering plant at Chicago, designed to produce self-fluxing sinter. Planned capacity for the new plant was to be 3,000 tons/day, and completion was scheduled for the fall of 1960.

Nearly 7.2 million short tons of domestic iron and manganiferous ores (excluding agglomerates) was consumed in blast and steel furnaces and agglomerating plants in Illinois in 1959. About 834,000 tons of foreign iron ore also was consumed. Other materials consumed in Illinois blast furnaces included nearly 4.2 million tons of coke and nearly 2.1 million tons of limestone and dolomite.

Steel production was 8,175,116 short tons (66 percent of capacity), according to the American Iron & Steel Institute, an increase of 18 percent over 1958. By the end of 1959, total annual steel capacity of plants in the State increased to 12,794,400 tons. New steelmaking facilities included one open-hearth and seven electric furnaces. In July the Acme Steel Co. began producing steel at its new $33 million plant at Riverdale. The plant (annual capacity, 450,000 tons) was the first in the United States to make steel by the combination of hot blast cupolas and top-blown oxygen converters.[5]

Other Metals.—Lindsay Chemical Division of American Potash and Chemical Corp. manufactured refined thorium compounds from monazite concentrate at West Chicago. Lindsay Chemical, the world's largest manufacturer of these compounds, had been one of the prime

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[5] American Metal Market, Acme Pours First Steel in Newest Facility in Illinois: Vol. 66, No. 134, July 10, 1959, p. 1.

AEC contractors in supplying thorium needed for research and development under the Reactor Development Program. The company also produced rare-earth compounds. The Federal Bureau of Mines continued research on production of thorium from domestic ores and development of methods for producing high-purity thorium.

Some ores in the State contain valuable small quantities of certain metals, such as cadmium, gallium, and germanium, which were recovered in later processing stages at plants in Illinois or other States. Value of these byproduct metals is not included in the total value of State mineral production.

REVIEW BY COUNTIES

Mineral output, excluding liquid fuels and natural gas, was reported from 94 of the 102 counties in Illinois in 1959. Ten counties each recorded a value of mineral production exceeding $10 million. La Salle County led the State, furnishing 6 percent of the total value of minerals produced. Other major mineral-producing counties included Christian, Cook, Franklin, Fulton, Jefferson, Perry, St. Clair, Saline, and Williamson.

The total value of mineral output for 56 counties increased over 1958. Decreases were recorded for 39 counties. Details on liquid fuels and natural gas operations, for which county breakdowns were not available, are excluded from the county-review section.

Adams.—The Marblehead Lime Co. and Menke Stone & Lime Co. produced quick and hydrated lime at plants near Marblehead and Quincy, respectively, for chemical, industrial, and building purposes. Underground limestone mines were operated by these companies and the Black White Limestone Co. Companies producing limestone from open quarries included Missouri Gravel Co., Western Illinois Stone Co., and Roy Poppenhager. Output of limestone in the county was used for concrete aggregate and roadstone, agriculture, lime manufacturing, flux, mineral food, various fillers, riprap, and other purposes. Roadstone was produced under contract for Riverside Township and the State highway department.

Bituminous coal was produced by Triple S Mines from a strip mine near Augusta. Output was cleaned by jigging methods and sold for local consumption.

Quincy Sand Co. operated a dredge near Quincy and produced sand and gravel for building, fill, and other purposes. Blick's Construction Co. produced sand for various purposes near Quincy. The Illinois Highway Department contracted for paving sand.

Alexander.—Ozark Minerals Co. and Tamms Industries, Inc., produced tripoli (amorphous silica) from underground mines near Elco and Tamms, respectively. Both companies operated processing plants, where the crude material was ground to a very fine mesh and dried. Most of the milled material was bagged and shipped to consumers by rail. Output increased in quantity and value over 1958.

Western Fire Brick Co. produced sandstone near Elco. Crude material was shipped to the Company's East St. Louis plant for grinding. Output was used chiefly as a refractory material for furnace lining.

TABLE 12.—Value of mineral production in Illinois, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Adams	$1,773,784	$1,847,868	Stone, lime, coal, sand and gravel.
Alexander	219,853	255,150	Tripoli, sand and gravel, stone.
Bond	215,029	(2)	Sand and gravel.
Boone	109,010	92,803	Sand and gravel, stone.
Brown	77,164	322,757	Stone, sand and gravel, clays, coal.
Bureau	2,533,212	(2)	Coal, sand and gravel, stone, clays.
Calhoun	38,753	19,324	Stone, sand and gravel.
Carroll	342,657	91,101	Sand and gravel, stone.
Cass	----------	400	Sand and gravel.
Champaign	187,926	241,429	Do.
Christian	(2)	(2)	Coal, stone.
Clark	(2)	632,681	Stone, sand and gravel.
Clay	25,000	(2)	Stone.
Clinton	394,819	416,395	Stone, coal, sand and gravel.
Coles	(2)	(2)	Stone, sand and gravel.
Cook	26,618,246	24,656,565	Stone, lime, clays, sand and gravel, peat.
Crawford	(2)	(2)	Sand and gravel.
Cumberland	(2)	124,947	Do.
De Kalb	226,893	428,916	Stone, sand and gravel.
De Witt	(2)	96,391	Sand and gravel.
Douglas	2,176,833	2,159,511	Coal.
Du Page	(2)	(2)	Stone, sand and gravel.
Edwards	33,513	29,100	Clays.
Effingham	54,986	(2)	Stone.
Fayette	42,795	94,182	Sand and gravel, clays.
Ford	109,250	125,812	Sand and gravel.
Franklin	19,758,759	(2)	Coal.
Fulton	19,766,933	21,906,792	Coal, sand and gravel, stone.
Gallatin	284,286	509,366	Coal, sand and gravel.
Greene	185,939	296,868	Stone, clays, coal.
Grundy	(2)	(2)	Clays, sand and gravel.
Hancock	321,525	275,059	Stone.
Hardin	9,785,734	8,287,358	Fluorspar, zinc, stone, lead, sand and gravel.
Henderson	255,066	254,112	Stone.
Henry	525,771	457,722	Coal, sand and gravel.
Iroquois	----------	840	Sand and gravel.
Jackson	5,027,639	(2)	Coal, stone, sand and gravel.
Jefferson	(2)	(2)	Coal, stone.
Jersey	40,800	(2)	Stone.
Jo Daviess	(2)	(2)	Zinc, lead, stone.
Johnson	549,090	986,108	Stone, sand and gravel.
Kane	1,592,776	2,447,514	Sand and gravel, stone, peat.
Kankakee	3,982,257	2,347,021	Stone, coal, clays, sand and gravel.
Kendall	(2)	(2)	Stone, sand and gravel.
Knox	9,451,051	9,615,582	Coal, stone, clays, sand and gravel.
Lake	749,958	985,914	Sand and gravel, clays, peat.
La Salle	35,137,126	35,340,757	Cement, sand and gravel, stone, clays, coal.
Lawrence	89,404	170,579	Sand and gravel.
Lee	(2)	(2)	Cement, stone, sand and gravel, clays.
Livingston	1,946,254	1,968,458	Stone, clays, sand and gravel, coal.
Logan	829,301	(2)	Sand and gravel, stone, coal.
McDonough	495,491	200,428	Stone, clays.
McHenry	2,949,613	2,797,321	Sand and gravel, stone.
McLean	1,128,949	507,128	Sand and gravel.
Macon	(2)	(2)	Sand and gravel.
Macoupin	1,752,354	1,577,488	Coal.
Madison	4,298,470	4,336,809	Coal, stone, sand and gravel, clays.
Marion	72,230	84,281	Coal.
Marshall	392,658	(2)	Clays, sand and gravel.
Mason	3,629	3,435	Sand and gravel.
Massac	(2)	(2)	Stone, sand and gravel.
Menard	470,377	500,089	Stone, coal, clays.
Mercer	270,903	243,855	Do.
Monroe	(2)	(2)	Stone, sand and gravel.
Montgomery	(2)	(2)	Coal, stone.
Moultrie	----------	9,835	Sand and gravel.
Ogle	1,404,396	1,294,565	Sand and gravel, stone.
Peoria	3,918,147	4,065,072	Sand and gravel, coal, stone.
Perry	13,774,584	12,132,382	Coal.
Pike	299,569	309,448	Stone, sand and gravel.
Pope	9,273	3,991	Sand and gravel.
Pulaski	(2)	(2)	Stone, clays, sand and gravel.
Putnam	3,544	2,250	Sand and gravel.
Randolph	3,374,146	4,458,949	Coal, stone, sand and gravel.
Rock Island	985,652	784,095	Stone, sand and gravel, clays.
St. Clair	22,636,012	23,671,114	Coal, stone, sand and gravel, clays.
Saline	(2)	10,714,958	Coal.

See footnotes at end of table.

TABLE 12.—Value of mineral production in Illinois, by counties [1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Sangamon	$1,210,819	$1,069,841	Sand and gravel, coal, clays.
Schuyler	(2)	(2)	Coal, stone, sand and gravel.
Scott	(2)	(2)	Stone, sand and gravel.
Shelby	43,500	(2)	Do.
Stark	(2)	----------	
Stephenson	285,155	161,743	Do.
Tazewell	(2)	1,233,114	Sand and gravel, clays.
Union	746,560	1,062,963	Stone, sand and gravel.
Vermilion	5,832,257	6,763,731	Coal stone, clays, sand and gravel.
Wabash	259,654	(2)	Sand and gravel, coal.
Warren	(2)	103,652	Stone.
Washington	201,426	368,939	Stone, coal.
White	171,331	154,867	Sand and gravel.
Whiteside	330,513	285,592	Stone, sand and gravel.
Will	7,166,402	8,870,394	Sand and gravel, coal, stone.
Williamson	23,955,243	25,052,366	Coal, stone.
Winnebago	2,239,984	1,221,841	Sand and gravel, stone.
Woodford	(2)	(2)	Sand and gravel.
Undistributed	[3] 330,720,265	345,839,864	
Total	[3] 576,862,000	577,372,000	

[1] County figures exclude gem stones, petroleum, natural gas, natural-gas liquids, and some stone and sand and gravel for which data by counties are not available; these are included with "Undistributed." The following counties did not report production: Edgar, Hamilton, Jasper, Morgan, Piatt, Richland, and Wayne.

[2] Figure withheld to avoid disclosing individual company confidential data; included with" Undistributed."

[3] Revised figure.

Sand and gravel for building and road construction and engine use was produced by the H. H. Halliday Sand Co. operating a dredge on the Ohio River near Cairo. The State highway department contracted for paving gravel.

Boone.—Crushed limestone for agriculture and roadstone was produced by Belvidere Lime Quarry, which operated a portable plant near Belvidere. Charles Lee & Sons reported no output of limestone in the county in 1959.

Christensen & Smith operated a portable sand and gravel plant near Capron and produced gravel for building and road construction. Paving gravel was produced under contract for the State and county highway departments. Munson Bros. & Co., former producer of clay and manufacturer of draintile, ceased operations in 1959.

Brown.—T. F. Hollembeak & Sons produced crushed limestone for agriculture and roadstone and sand and gravel for roads and fill near Mount Sterling. Missouri Gravel Co. produced crushed limestone chiefly for roads. The State highway department contracted for paving gravel.

Clay was produced near Mount Sterling by the Frederic Brick & Tile Co. Output was used by the company for manufacturing building brick and draintile. K. D. Malcomson mined coal from a strip pit near Mount Sterling. Output was sold locally.

Bureau.—Midland Electric Coal Corp.'s strip mine near Mineral was the only active coal mine in the county. The entire output was cleaned at the company plant, which also processed coal from the Victoria mine of Midland Collieries, Inc., in Knox County. Shipments to consumers were primarily by rail. Part of the output was for local consumption.

Sheffield Shale Products Co. mined clay near Sheffield and used the material for manufacturing building brick and other heavy clay products.

Sand and gravel was produced by five commercial companies, operating portable and fixed plants near Manlius, Princeton, Spring Valley, Walnut, and Wyanet. Herbolsheimer Gravel Co. discontinued operations. The county highway department produced paving gravel. Roadstone and paving gravel was produced under contract for the State Highway Department. The New Jersey Zinc Co. operated a zinc smelter near Depue.

Champaign.—Crude perlite mined outside the State was processed by the Ryolex Corp. at Champaign. The expanded product was sold chiefly for use as lightweight aggregate in plaster and concrete.

Several companies operated fixed and portable sand and gravel plants near Ludlow and Mahomet. Output was for building and road construction, fill, and other purposes. Paving sand and gravel was produced under contract for the State highway department.

Christian.—Coal was produced near Pawnee by the Peabody Coal Co. from its No. 10 underground mine, the largest producing bituminous-coal mine in the United States in 1959. Approximately 3.8 million tons was produced, a 30-percent increase over 1958. The entire output was cleaned by jigging methods.

Crushed limestone was produced by Tri-County Stone Co. and Edinburg Quarries near Nokomis and Edinburg, respectively. Output was used for agriculture and roads.

Clinton.—Underground mines operated by Citizens Coal Co. and Marion County Coal Mining Corp. at Breese and Centralia, respectively, furnished all coal produced in the county in 1959. Most of the output was consumed locally. The Glenridge mine of Marion County Coal Mining Corp. extends into Marion County.

Crushed limestone for agriculture and roads was produced by the Buehne Quarry Co. several miles north of Breese and by the Alphonse Huelsman Quarry Co. near Carlyle. The county highway department produced gravel for building.

Cook.—Total value of mineral output in Cook County was nearly $25 million. Crushed limestone was produced for concrete aggregate and roadstone, agriculture, railroad ballast, flux, asphalt filler, filtering, manufacturing lime and dead-burned dolomite, and other purposes. Material Service Corp. operated four quarries near Chicago, Lyons, McCook, and Thornton. Consumers Co. produced limestone from its Bellwood and McCook quarries and completed construction of new crushing facilities at the McCook quarry. Dolese & Shepard Co. quarried limestone near Hodgkins. Other producers of crushed limestone were Arcole Mid-West Corp. and Lemont Stone & Material Co., operating quarries near Lemont. The State highway department contracted for roadstone.

Several companies operated fixed sand and gravel plants near Chicago, Elgin, and Worth. Output was for building and roads, railroad ballast, sandblasting, and other purposes. Paving sand was produced under contract for the State highway department.

Marblehead Lime Co. operated plants at South Chicago and Thornton and produced quicklime and hydrated lime for refractories, chemical and industrial purposes, and building. Standard Lime & Cement Co. produced quicklime at La Grange for refractories.

Producers of clay in the county included Brisch Brick Co., Carey Brick Co., Chicago Brick Co., Illinois Brick Co., and Tuthill Building Materials Co. Output was used by the companies chiefly for manufacturing building brick.

Henry Frenzer produced peat for use as a soil conditioner. Sulfur was recovered as a byproduct at the Lemont Refinery of Pure Oil Co. Ground mica was produced by U.S. Mica Co., Inc., at its dry-grinding plant at Forest Park. Crude perlite mined in Western States was processed by the Silbrico Corp. at Chicago. The Zonolite Co. exfoliated vermiculite at Chicago.

Refined thorium compounds and rare-earth compounds were manufactured from monazite concentrate by Lindsay Chemical Division of American Potash & Chemical Corp.

Blast and steel furnaces and coke-oven plants were operated in the Chicago area. Producers of pig iron included Interlake Iron Corp., International Harvester Co., Republic Steel Corp., United States Steel Corp., and Youngstown Sheet & Tube Co. Most of the blast furnaces were shut down during the prolonged steel strike. International Harvester Co. continued operating during the strike. In 1959 Youngstown Sheet & Tube Co. resumed operating two of its three furnaces; all were idle throughout 1958. Interlake Iron Corp. planned to construct a self-fluxing sinter plant at its Chicago facilities. Designed capacity of the plant was 3,000 tons per day. Expected completion date was the fall of 1960. All companies producing pig iron operated coke ovens except United States Steel Corp.

Steel-producing companies included Acme Steel Co., Borg-Warner Corp., Ceco Steel Corp., Columbia Tool Steel Co., A. Finkl & Sons Co., H. M. Harper Co., International Harvester Co., Republic Steel Corp., and United States Steel Corp. Acme Steel Co. began producing steel at its new $33 million Riverdale plant. Annual capacity of the plant was 450,000 tons.

Douglas.—Moffat Coal Co. produced 482,000 tons of coal from an underground mine near Murdock. The entire output was cleaned by jigging. Nearly 55 percent of the total production was shipped to consumers by rail. The remainder was for local consumption.

Du Page.—The Elmhurst-Chicago Stone Co. produced crushed limestone from its quarry at Elmhurst for concrete aggregate, roadstone, and agriculture. The company also operated fixed sand and gravel plants at Winfield and Warrenville and produced material for building and roads. Novel features at the Warrenville plant included a central radial stacker and a water-reclaiming arrangement.[6] The stacker could be used in conjunction with dry processing or in the washing plant, enabling the company to stockpile unwashed roadbase gravel or produce washed concrete aggregates. Two 4-acre settling ponds and three smaller ones for reclaiming wash water were built to solve a problem of water drawdown in the area. Whiting Cut Stone Co. produced dimension limestone near Villa Park. Output was used chiefly for architectural purposes.

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[6] Rock Products, Radial Stacker: Key to Two-in-one Aggregate Plant: Vol. 62, No. 4, April, 1959, pp. 90–93.

Edwards.—The Albion Brick Co. produced miscellaneous clay at Albion and used the material for manufacturing building brick.

Fayette.—Diller Shale Products Co. produced clay for manufacturing draintile at its plant near St. Elmo. Approximately three-fourths of the finished product was sold to farmers, and the remainder to lumber yards and other retailers for construction. Raw material was mined by a dragline about a half mile from the plant and hauled to the plant by truck. The company had six beehive kilns, which were gas fired with coal used for standby purposes. The company employed about 20 men, generally working throughout the year.

Burtschi Sand & Gravel Co. and Melvin Dugan operated fixed sand and gravel plants and produced material for building, roads, and other uses. The State highway department contracted for paving gravel. Forrest Lutz, formerly Chas. D. Lutz & Sons, produced natural-bonded molding sand from a pit near Mulberry Grove. Most of the output was shipped by rail to steel companies at Alton and Granite City. Smaller quantities were sold to various foundries. Several hundred tons was sold for paving.

Franklin.—Over 4.6 million tons of coal was produced from four underground mines in the county. Output was from the Nos. 9, 14, and 22 mines of Old Ben Coal Corp. and the Orient No. 2 mine, which was operated during the first half of 1959 by the Chicago, Wilmington & Franklin Coal Co. and the latter half of the year by the Orient No. 2 Coal Co. Approximately 84 percent of the county output was cleaned at preparation plants at each of the mines. Old Ben Coal Corp. continued development of the No. 21 underground mine near Sesser. Initial production was expected early in 1960. In April Freeman Coal Mining Corp. began developing a new underground mine, the Orient No. 5, near Benton. Planned capacity was 7,000 tons per day, and production was scheduled for 1960.

Fulton.—Fulton County was the third largest coal-producing county in the State in 1959 and ranked first in output from strip mines. Production was more than 5.1 million tons, a 9-percent increase over 1958. All but 25,000 tons was furnished from 12 strip mines. Three underground mines were operated in the county. About one-fourth of the total county output was cleaned at seven plants by jigging and heavy-media and pneumatic methods. About 68 percent of the total production was shipped to consumers by rail, 24 percent by barge, and the remainder by truck. The United Electric Coal Companies began developing the Banner No. 27 strip mine at Glasford. The mine was expected to be in full operation in the spring of 1960. A new Kolbe wheel excavator was put into service for stripping overburden at The United Electric Coal Companies Cuba No. 9 mine. The machine had 10 buckets and a capacity of about 3,500 cu. yds./hour. Pschirrer Coal Co., ceased operations at its No. 3 underground mine near Canton in April.

Several companies operated stationary sand and gravel plants and produced material for buildings, roads, and other purposes. The State highway department contracted for roadstone.

Gallatin.—Coal production in the county increased 56 percent over 1958. Output was from two underground, one auger, and three strip mines in the southern part of the county. Nearly 88 percent of the output was shipped by barge on the Ohio River. No crushing, treating, or mechanical cleaning was performed at any of the mines. In January, Bennett Coal Co., acquired the auger mine formerly operated by Barbie Dee Mines, Inc., but suspended operations in December.

Sand and gravel for building and roads was produced by the Gail Denny Sand Co. and the county highway department. Paving sand and gravel was produced under contract for the State highway department.

Greene.—Clay was produced near White Hall by the American Vitrified Products Co. Output was used by the company for manufacturing vitrified sewer pipe. Wyatt Clay Mines produced clay near Roodhouse and used the material for manufacturing building brick. Crushed and broken limestone for agriculture, roads, and riprap was produced by several companies. Coal for local consumption was produced by Birch Creek Coal Co. from a strip mine near Roodhouse.

Grundy.—Illinois Clay Products Co. mined clay from pits near Coal City and Morris. Output was for refractory use and heavy clay products. Material Service Corp. produced sand and gravel near Morris chiefly for road use. The State highway department contracted for paving sand. No coal was produced from the Grundy County portion of Peabody Coal Co.'s strip mine near Wilmington.

Hardin.—Shipments of finished fluorspar decreased about one-fourth from 1958 and were the lowest in 5 years. Termination of Government purchase programs in 1958 and a substantial increase in imports were the chief reasons for the marked drop in output. Major producers of fluorspar were Aluminum Company of America, Minerva Oil Co., and Ozark-Mahoning Co. Aluminum Company of America operated its group of mines and mill near Rosiclare throughout the year. Mill products included Acid-grade fluorspar and lead and zinc concentrates. A small quantity of custom ore was processed at the company mill.

Minerva Oil Co. operated its Crystal and No. 1 mines and mills near Cave-in-Rock, part of the year. Operations were shut down entirely for a period in the fall because of the depressed market. Toward the close of the year the company was operating intermittently. Fluorspar and zinc concentrates were produced at both mills. Lead concentrate also was produced at the Crystal mill. Some custom ore was treated at the Crystal mill.

Ozark-Mahoning Co. operated its mines near Cave-in-Rock and its Rosiclare flotation mill, where finished fluorspar and lead and zinc concentrates were produced. A quantity of custom ore was processed at the company mill. A fire occurred in the crushing and screening department of the mill in February and forced the plant to close for about 2 weeks. In September the company shut down its mines and plant for 1 week because of poor market conditions.

In the latter half of 1959, Mackey-Humm Mining Co. operated its mill, which had been operated under lease in 1958 by Southern Illinois Mining Co. Material for the plant was furnished from stockpile and purchases from other companies. Goose Creek Fluorspar Mining Co. mined fluorspar ore, which was processed by other companies. A small quantity of crude fluorspar was mined by Tamora Mining Co.

from the Eureka mine, leased from Rosiclare Lead & Fluorspar Mining Co. The latter company reported sales of finished fluorspar. Hoeb Mining Co. mined fluorspar-lead-zinc ore, which was shipped to plants of other companies for processing. Several small mines in the county closed, chiefly because Government purchasing ended.

Limestone was quarried by several companies and crushed for roadstone, flux, and agriculture. The State highway department contracted for roadstone and paving sand. Fluorite specimens were collected principally for personal collections.

Henry.—Coal production in Henry County was from two underground mines operated by Cook's Gem Mine, Inc., and Shuler Coal Co. The mine operated by the former company was abandoned in April. Approximately 94 percent of the total county output was shipped to consumers by rail. Sand and gravel was produced by three commercial companies for building and roads. The county highway department contracted for paving sand.

Jackson.—Over 1.2 million tons of coal was produced in the county by Elk Coal Co., Farley Bros. Coal Co., and Truax-Traer Coal Co., from two underground and two strip mines. The latter company operated both an underground and a strip mine. Truax-Traer Coal Co. and Elk Coal Co. operated preparation plants in the county.

The Illinois Quarry Co. produced crushed limestone from a quarry near Ava for agriculture and roads. Sand and gravel for building, roads and other purposes was produced by Lawder Sand Co. near Grand Tower.

Jefferson.—Jefferson County was one of the major coal-producing counties in the State, with output of over 3.1 million tons, principally from the Orient No. 3 underground mine, operated by Freeman Coal Mining Corp. near Waltonville. The mine was one of the largest producing coal mines in the Nation in 1959. Approximately 23,000 tons of coal was produced by Belle Rive Mining Co. from a strip mine near Belle Rive. The Randall Stone Co. produced crushed limestone near Mount Vernon for roads.

Jo Daviess.—Eagle-Picher Co. mined zinc ore from its Graham, Snyder, Spillane, and Feehan properties and O'Rourke mine. Ore was treated at the company Graham mill, which also processed ores mined by the company in Wisconsin. Tri-State Zinc, Inc., produced lead-zinc ore from the Gray and Amelia mines near Galena. Ore from both mines was hauled by truck to the company Gray mill for treatment. Hickory Hill Mining Co. mined and shipped nearly pure galena from the Hartwick mine. Some zinc-lead ore produced was processed at the Graham mill.

Crushed limestone was produced by three companies, operating portable plants near Elizabeth, Galena, and Warren. Output was used principally for roadstone and agriculture. The county highway department contracted for roadstone.

Kankakee.—The sole producer of coal in the county was Peabody Coal Co., operating a strip mine near Braidwood. Production was also reported from the Will County portion of this mine. Output decreased from 1958.

Lehigh Stone Co. and Manteno Limestone Co. produced crushed limestone near Lehigh and Manteno, respectively. Output was for roadstone, railroad ballast, agriculture and other purposes.

Miscellaneous clay used for manufacturing building brick and other heavy clay products was produced near Kankakee and St. Anne. Producers included Eastern Illinois Clay Co., Kankakee Clay Products Co., and St. Anne Brick & Tile Co. The State highway department contracted for paving sand.

Knox.—Approximately 2.1 million tons of coal was produced from four strip mines, operated by Midland Collieries, Inc., Stonefort Corp., and Midland Electric Coal Corp. The latter company operated two mines; output was cleaned at the company's Middle Grove plant. Stonefort Corp., also operated a cleaning plant. Output from Victoria No. 5 mine of Midland Collieries, Inc., was cleaned at the Bureau County plant of Midland Electric Coal Corp. Almost all county coal production was shipped to consumers by rail.

The Abingdon Rock Co., Inc, produced crushed limestone near Abingdon for roadstone and agriculture. Clay was produced near Galesburg by the Purington Brick Co. for use chiefly in manufacturing building brick. L. K. Bandy Construction Co. operated a portable plant near Maquon and produced sand and gravel for roads and fill.

Abingdon Potteries, Inc., operated a feldspar-grinding plant at Abingdon. Crude feldspar, used for grinding, was mined by the company outside the State.

Lake.—Sand and gravel was produced by nine commercial companies operating fixed and portable plants near Antioch, Barrington, Gurnee, Libertyville, and Wadsworth. Output was for building, roads and other purposes. The county highway department produced and contracted for paving gravel. Clay used for manufacturing building brick was produced near Deerfield by the National Brick Co. Peat was produced by the Milburn Peat Co. and Marvin Walker Peat Co. Output was used for soil conditioning.

The Chevrolet & Saginaw Grey Iron Foundry, Division of General Motors Corp., operated coke ovens at Waukegan and produced coke for foundries.

Crude perlite mined in Colorado and New Mexico was processed by the Lake Zurich Concrete Products Co. at its Lake Zurich plant. The expanded product was used as lightweight aggregate in plaster and concrete.

A new gypsum-products plant of National Gypsum Co. at Waukegan was dedicated in the fall of 1959. The plant manufactured wallboard, lath, plaster, and other building products for markets in northern Illinois and Wisconsin. Crude gypsum processed at the plant was mined by the company in Michigan.

La Salle.—La Salle County led the State in value of mineral output (excluding liquid fuels and natural gas). Portland and masonry cements were produced at La Salle by Alpha Portland Cement Co. and at Oglesby by Lehigh Portland Cement Co. and Marquette Cement Mfg. Co. The three companies also quarried limestone for use in manufacturing cement. Other limestone producers included Beardsley Stone Co. (formerly the Troy Grove Stone Co.), and Utica Stone Co., operating quarries near Sheridan and Utica, respectively. Output was for roadstone and agriculture. The Sheridan Stone Co. ceased operations in January.

Material Service Corp. produced shale near Ottawa and used the material in manufacturing lightweight aggregate at its new two-kiln plant on the Illinois River. Aggregate was shipped to consumers by rail and barge. The Conco-Meier Co. produced clay near Lowell for manufacturing building brick. The company operated 18 beehive kilns fired by coal and oil. Clay was mined by dragline and hauled about 2 miles to the plant by truck for processing. LaClede-Christy Co. Division of H. K. Porter Co., Inc., produced fireclay for refractories near Ottawa. Matthiessen & Hegeler Zinc Co. produced fireclay from an underground mine near La Salle. This clay was used by the company in manufacturing zinc retorts for the company zinc smelter at La Salle. Alpha Portland Cement Co. and Marquette Cement Mfg. Co. produced shale for their own use in manufacturing cement. Hydraulic-Press Brick Co. produced clay for its own use from a pit formerly operated by Arthur Mart.

Sand and gravel was produced by nine commercial companies for various purposes, including building, roads, and special uses such as glass, molding, grinding and polishing, sandblasting, engine use, filtering, oilfield fracturing, filler, enamel, and other uses. Operations were chiefly in the vicinity of Ottawa.

Lee.—Portland and masonry cements were produced by the Medusa Portland Cement Co. at Dixon. The company also produced clay and limestone for use in manufacturing cement. Crushed limestone also was produced by several other companies operating portable plants near Dixon, Franklin Grove, and Rochelle. Fixed and portable sand and gravel plants were operated by three companies near Dixon, Nelson, and Steward. Output was for building, roads, and fill. The State highway department contracted for paving gravel.

Livingston.—The Hydraulic-Press Brick Co. produced clay near Streator for use in manufacturing building brick. Clay was mined near Chatsworth by the Diller Tile Co. and used by the company for manufacturing building brick. Streator Drain Tile Co. produced clay near Streator. Output was used for manufacturing draintile and other heavy clay products. The company also mined coal in conjunction with its claypit and consumed the entire output in manufacturing clay products.

Crushed and broken limestone was produced by five companies from quarries near Chenoa, McDowell, and Pontiac. Output was used for roadstone, agriculture, asphalt filler, and riprap. Paving sand and gravel was produced near Manville. The State highway department contracted for paving sand.

Logan.—The Lincoln Sand & Gravel Co. operated a dredge near Lincoln and produced sand and gravel for building, roads, engine use, fill, and other purposes. Output decreased from 1958 because of poor weather conditions late in the year. Rocky Ford Limestone Co. quarried limestone several miles southwest of Lincoln. Output was for roadstone and agriculture. Operations were temporarily halted in the spring because of flood conditions.

The Lincoln Coal Mining Co. produced 25,000 tons of coal from an underground mine near Lincoln. The entire output was for local consumption.

Macoupin.—Coal production decreased 14 percent from 1958. Output was from two underground mines—the Little Dog mine operated by the Little Dog Coal Co. at Gillespie, and the North mine operated by Virden Mining Corp. at Virden. The latter mine closed in December because of bankruptcy. Approximately 83 percent of county coal output was shipped by rail. The entire output of the Little Dog Coal Co. was cleaned by jigging and tabling.

Vermiculite produced outside the State was exfoliated at the Girard plant of International Vermiculite Co. and used chiefly for insulation.

Madison.—The Livingston-Mt. Olive Coal Co. and Lumaghi Coal Co. produced coal from underground mines near Livingston and Collinsville, respectively.

The Reliance Whiting Co. produced crushed and broken limestone near Alton for roadstone, agriculture, riprap, and other purposes. Crushed limestone for roadstone and agriculture also was produced near Godfrey by C. M. Lohr, Inc. and near Alton by the Mississippi Lime Co., which obtained the material from an underground mine. The company also operated a dredge near Alton and produced sand and gravel for various purposes. Building and paving sand was produced by several other companies near Alton and Granite City. The State highway department contracted for paving sand.

Clay was produced by the Alton Brick Co. near Alton for use in manufacturing building brick. Western Fire Brick Co. manufactured firebrick at Granite City from clay produced in Missouri. Sandstone quarried by the company in Alexander County was crushed at the Granite City plant and used for patching furnaces.

The Granite City Steel Co. operated coke ovens and blast and steel furnaces at Granite City. The company continued operations throughout the steel strike by extension of its labor contract with the United Steelworkers of America. Late in 1959 the company began constructing a new blast furnace with a capacity of 1,800 tons/day of pig iron. The new furnace was to replace the older of the company's two blast furnaces and was expected to be completed in the summer of 1960. Laclede Steel Co. produced steel from open-hearth furnaces at Alton.

After more than 50 years of continuous operation, the lead smelter of American Smelting & Refining Co. at Alton closed in July. Termination of a contract by St. Joseph Lead Co. for smelting lead concentrates was the chief reason for the shutdown. However, import quotas established in the fall of 1958 also were a factor in closing the plant, since they made it virtually impossible to obtain an ore supply from other sources. Early in 1959 American Smelting & Refining Co. began production at its new secondary-aluminum-recovery plant adjacent to the lead plant. The Anlin Company of Illinois began production at its new sulfur-recovery plant at Hartford in October.

Marion.—Approximately 18,000 tons of coal was produced from an underground mine near Centralia by the Marion County Coal Mining Corp. Production also was reported from the Clinton County portion of the mine.

Marshall.—The Hydraulic-Press Brick Co. produced clay near Sparland and used the material for manufacturing building brick. Vernon Henry and Mitchell Wilson operated portable plants near La Rose and Lacon, respectively, and produced paving gravel.

McDonough.—Booz & Co. began producing clay near Colchester for use in manufacturing building brick and other heavy clay products. Several other companies also mined clay near Colchester. Output was for manufacturing pottery, stoneware, and heavy clay products.

Colchester Stone Co. and McClure Quarries, Inc., produced crushed and broken limestone near Colchester. Output was for roadstone, riprap, and agriculture.

Menard.—Production of coal decreased 14 percent from 1958. Two underground mines near Petersburg furnished the output, entirely for local consumption. Nearly a third of the production was treated with oil to allay dust. Less than 1,000 tons was produced by the Storey Coal Co., which surrendered its lease on an underground mine near Petersburg, in April. The mine was idle the remainder of the year.

Athens Stone Quarry and Indian Point Limestone Products produced limestone near Athens. Output was used for roadstone, riprap, and agriculture. Springfield Clay Products Co. mined clay near Petersburg and used the material for manufacturing building brick and other heavy clay products.

Mercer.—Coal was produced from an underground mine near New Windsor and a strip mine near Viola. The latter, previously operated by Eddington Coal Co., was acquired by Viola Coal Co., in November. Approximately a third of the county coal output was shipped by rail; the remainder was trucked to local consumers.

Clay was produced near Aledo by the Hydraulic-Press Brick Co. Output was used by the company for manufacturing building brick. Linn Materials, Inc., produced crushed limestone near Viola for roads.

Montgomery.—Freeman Coal Mining Corp., the only coal producer in the county, operated the Crown underground mine at Farmersville. The entire output was cleaned by jigging and pneumatic methods. Crushed limestone for agriculture and roads was produced near Litchfield and Nokomis.

Peoria.—Approximately 325,000 tons of coal was produced in Peoria County, a slight decrease from 1958. Output from five strip mines comprised 92 percent of the production; the remainder was from three underground mines. The Howard Scott strip mine was acquired by Gibson Coal Co. in September. Two cleaning plants were operated in the county during the year.

Sand and gravel was produced by five companies at plants near Chillicothe and Peoria. Output was for building, roads, railroad ballast, and other uses. Paving sand and gravel was produced under contract for the city of Peoria and the State highway department. La Mar Stone Co., Long Rock Co., and Princeville Stone Co. produced crushed limestone for roadstone and agriculture. Demand for agricultural lime increased over the previous year.

Perry.—Perry County was one of the leading coal-producing counties in the State, with an output of 3.5 million tons. Total production decreased 11 percent from 1958, although output from strip mines increased about 10 percent. One underground and five strip mines were operated in 1959. Leading producers were Southwestern Illinois Coal Corp., Truax-Traer Coal Co., and The United Electric Coal Companies. Approximately 2.5 million tons of coal was cleaned at two plants operated by Truax-Traer Coal Co. and The United Electric Coal Companies. The Pyramid mine of Truax-Traer Coal Co. was abandoned in September.

Pope.—Fluorspar ore was mined by the Egyptian Mining Co. and Redd Mining Co. The crude ore was processed at plants in Hardin County, Ill., and Kentucky. Work was completed in May on a contract between the OME, U.S. Department of the Interior, and the New Jersey Zinc Co. covering fluorspar exploration. A certificate of discovery was issued. The Government advanced 50 percent of approved costs of the project, about $18,000.

The county highway department produced gravel for building. The State highway department contracted for paving gravel.

Pulaski.—The Columbia Quarry Co. produced crushed and broken limestone near Ullin. Output was used for roadstone, railroad ballast, riprap, and agriculture. Star Enterprises, Inc., produced clay near Olmsted and sold the material for absorbent uses.

Randolph.—About 923,000 tons of coal was produced in the county, a 40-percent increase over 1958. Nearly 80 percent of the output was from an underground mine operated by Zeigler Coal & Coke Co. The remainder was from two strip mines operated by Southwestern Illinois Coal Corp. and Ritter Coal Co. The latter company suspended operations at its Red Fox No. 3 mine in mid-1959. The Beveridge underground mine of Miner's Coal Co. was closed, and the shaft filled in March.

Limestone was produced from underground mines operated by Allied Chemical & Dye Corp., Chester Quarry Co., and Al Stotz Quarry. Output was used for roadstone, agriculture, in alkali works, and for other purposes. The Illinois State Penitentiary discontinued quarrying operations near Menard. Southern Illinois Sand Co. operated a dredge near Chester and produced sand for building, paving, engine use, fill, and other purposes.

Rock Island.—Crushed limestone for agriculture and roadstone was produced by several companies near Cordova, Hillsdale, and Milan. Sand and gravel was produced at plants near Cordova, Milan, and Moline. Output was used chiefly for building, roads, and fill. Paving sand and gravel was produced under contract for the State highway department. Blackhawk Aggregates, Inc., formerly operating a dredge near Milan, discontinued operations.

Clay was produced near Carbon Cliff by the Van-Packer Co. Division of The Flintkote Co. Output was used by the company in manufacturing flue liners.

St. Clair.—The county ranked second in the State in coal production, 5.3 million tons in 1959. Production was reported by six companies from five underground and four strip mines. Strip mines furnished 59 percent of the county output, and underground mines the remainder. Major producers were Peabody Coal Co. and Mid-Continent Coal Co. Approximately 99 percent of the county coal production was cleaned at eight preparation plants. In the latter part of the year Peabody Coal Co. purchased a nine-bucket wheel excavator costing about $2.5 million. Plans were to use the machine for removing overburden at the company's River King mine near Freeburg.

Columbia Quarry Co., East St. Louis Stone Co., Hecker Quarry, Inc., and Casper Stolle Quarry & Construction Co. produced limestone in the county. Output was used for roadstone, agriculture, riprap, flagging, rubble, and other purposes. The county highway department contracted for roadstone. Sand for building, road, engine use, and fill was produced near East St. Louis by Missouri-Illinois Materials Co. The State highway department contracted for paving sand.

Clay was produced near East St. Louis by the Hydraulic-Press Brick Co. and used by the company chiefly for manufacturing lightweight aggregate. Hill Brick Co produced clay near Belleville for use in manufacturing building brick.

Crude barite produced outside the State was ground at a plant operated at East St. Louis by C. K. Williams & Co. The ground product was sold for filler in rubber and paint and for pharmaceutical purposes.

Zinc smelters were operated by the American Zinc Co. of Illinois at Fairmont City and Monsanto. The Aluminum Company of America produced aluminum fluoride, gallium, and synthetic cryolite at its East St. Louis plant.

Saline.—Nearly 2.6 million tons of coal was produced from one auger, two underground, and six strip mines. Leading producers were Sahara Coal Co., Inc. and Saxton Coal Corp. Central preparation plant of Sahara Coal Co., Inc., cleaned coal from the Nos. 5 and 16 underground mines and No. 6 strip mine. Saxton Coal Corp. also operated a preparation plant. Both plants cleaned coal by jigging methods. K. & W. Coal Co. abandoned its No. 2 strip mine in March. The company's No. 1 mine was acquired by J. W. Coal Co. A new strip mine was opened in August by the H. & V. Coal Co. Paddock Auger Mining Co. ceased auger-mining operations in the county in November. Auger mines formerly operated by Barbie Dee Mines, Inc., were acquired by Bennett Coal Co. in January. The latter company produced less than 1,000 tons in 1959.

Sangamon.—Coal was produced from two underground mines near Cantrall by Cantrall Coal Co. and Eddy Coal Co. The entire output was trucked to local consumers. Approximately 90 percent of county production was loaded into mine cars and shuttle cars by two mobile-loading machines; the remainder was hand-loaded.

Posten Brick & Concrete Products Co. mined clay near Springfield and used the material chiefly for manufacturing building brick and lightweight aggregate. Springfield Clay Products Co. produced clay near Springfield and used the output for manufacturing draintile and floor and wall tile.

Buckhart Sand & Gravel Co., Inc., Clear Lake Sand & Gravel Co., and Springfield Sand & Gravel Co. produced sand and gravel near Springfield for building, roads, and other purposes. Paving gravel was produced under contract for the city of Springfield.

Schuyler.—An 81-percent increase in value of mineral output in the county was primarily due to a marked increase in coal production. Key strip mine operated by Peabody Coal Co. furnished more than 99 percent of the county coal output; remainder was from an underground mine operated by D. & D. Coal Co. More than 89 percent of the shipments to consumers was by barge on the Illinois River, 9 percent by rail, and the remainder by truck. Peabody Coal Co. operated a cleaning plant at the Key mine.

Elas Quarry produced crushed limestone for agriculture and roadstone near Rushville. The State highway department contracted for roadstone and paving gravel.

Stark.—Late in 1959 Stonefort Corp. began developing a new coal mine, the Allendale, near Wyoming. The strip mine was expected to begin production early in 1960 with a daily capacity of approximately 2,800 tons. Contracts were made for cleaning and drying equipment.

Tazewell.—Sand and gravel was produced by several companies at plants near East Peoria, Mackinaw, Pekin, and Washington. Output was used for building, roads, railroad ballast, filter use, fill, and other purposes. Paving gravel was produced under contract for the State highway department.

Clay was produced by the Peoria Brick & Tile Co. near East Peoria. The material was used by the company for manufacturing building brick, utilizing a gas-fired tunnel kiln.

Vermilion.—Production of coal in Vermilion County was about 1.2 million tons, an increase of 10 percent over 1958. All mines operated were near Danville. Nearly 95 percent of the county output was from five strip mines; four underground mines furnished the remainder. Three preparation plants were operated during the year, and coal was cleaned from five mines. Major producers were Fairview Collieries Corp. and The United Electric Coal Companies. In April the underground mine of B–10 Coal Co. and Seymour Coal Co.'s strip mine were abandoned. Doo-Little Coal Co. began operating a new strip mine in November.

Crushed limestone for roads was produced by Material Service Corp. at its Fairmount quarry.

Western Brick Co. mined clay from two pits near Danville. Output was used by the company for manufacturing building brick and lightweight aggregate. Brick was manufactured in four gas-fired tunnel kilns; oil was used as standby fuel. The company used a traveling-grate sintering machine for producing lightweight aggregate. Fixed and portable sand and gravel plants were operated near Danville and Westville. Output was for roads and other purposes.

Wabash.—Allendale Coal Co. produced 1,300 tons of coal for local consumption from a strip mine near Allendale. The mine had been opened in 1958. However, less than 1,000 tons was produced in that year.

Washington.—Approximately 25,000 tons of coal was produced from underground mines operated by Bois Coal Co. and Venedy Coal Co., Inc. Most of the output was for local consumption.

Pitts Quarry produced crushed limestone near Radom for agriculture and roads.

Will.—Limestone was produced by Lincoln Stone Co., Material Service Corp., National Stone Co., and Illinois State Penitentiary. Output was for concrete aggregate and roadstone, railroad ballast, agriculture, asphalt filler, flux, and other uses. Sand and gravel was produced for building, roads, railroad ballast, and other uses. Producers included Chicago Gravel Co., Elmhurst-Chicago Stone Co., Material Service Corp., and C. H. Monk. The State highway department contracted for paving sand and gravel.

Peabody Coal Co. produced coal from the Will County portion of the Northern Illinois strip mine.

Crude perlite mined in New Mexico was expanded by F. E. Schundler, Inc., at its Joliet plant. The processed material was used as lightweight aggregate in plaster and concrete and for other purposes. The company's vermiculite plant was destroyed by fire in December 1958, and the company was acquired by Johns-Manville Perlite Corp. late in 1959.

Williamson.—Williamson County continued to be the leading coal-producing county in the State with output of 6.1 million tons, an increase of 2 percent over 1958. Fifteen underground mines supplied 61 percent of county output. The remainder was furnished by 11 strip mines. Major producers included Bell & Zoller Coal Co., Carmac Coal Co., Freeman Coal Mining Corp., Peabody Coal Co., Stonefort Corp., and Utility Coal Co. Nearly 97 percent of the coal marketed was cleaned at 12 preparation plants. About 96 percent of county production was shipped to consumers by rail. Several companies hauled coal by truck to the tipple of the abandoned Blue Bird No. 8 mine, where the coal was loaded into rail cars for shipment. A number of relatively small mines were abandoned and several new strip mines opened in 1959.

The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey, Indiana Department of Conservation.

By Donald F. Klyce [1] and Mary B. Fox [2]

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MINERAL production reached a new high in Indiana in 1959 and total value exceeded $200 million for the first time. Much of the increase resulted from a greater demand for sand and gravel and crushed stone. The value for most other commodities did not vary much from 1958. An increase in the price of coal (from $3.89 per ton to $4.05) caused the 1959 value to rise, although production was smaller. Similarly, a decrease in the price of petroleum (to $2.97 per barrel from $3.01) decreased the value of that commodity, although 1959 output was higher. Improvement of facilities for producing aluminum, cement, coke, gypsum, and steel continued during the year. The opening of the St. Lawrence Seaway during 1959 stimulated construction in the Northwestern Indiana industrial area.

TABLE 1.—Mineral production in Indiana [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Abrasives (whetstones) short tons	10	$10	5	$13
Cement, portland thousand 376-pound barrels	14,730	48,858	14,245	47,231
Clays	1,371	2,477	1,692	2,915
Coal [2]	15,022	58,506	14,804	59,954
Natural gas million cubic feet	378	59	[3] 600	[3] 100
Peat short tons	12,106	145	15,393	202
Petroleum (crude) thousand 42-gallon barrels	11,864	35,711	[3] 12,003	[3] 35,649
Sand and gravel	16,862	15,045	20,357	17,924
Stone	15,394	31,974	18,544	37,682
Value of items that cannot be disclosed: Masonry cement, natural cement (1958), and gypsum		7,539		8,817
Total Indiana [4]		197,677		207,701

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Related only to mines with an annual production of 1,000 tons or more.
[3] Preliminary figure.
[4] Total adjusted to eliminate duplicating value of clays and stone.

Employment and Injuries.—Preliminary information indicated that

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TABLE 2.—Summary of employment and injuries for selected mineral industries in Indiana[1]

Year and industry	Average number of men working	Total man-hours	Total lost-time injuries		Total days lost or charged	Injury frequency rate[2]	Injury severity rate[3]
			Fatal	Non-fatal			
1958							
Cement[4]	1,599	4,359,268	--------	9	(5)	2.06	(5)
Coal	3,719	5,899,435	3	275	35,575	47.12	6,030
Coke ovens	1,996	5,824,122	1	12	(5)	2.23	(5)
Limestone[6]	2,928	5,896,242	4	198	(5)	34.26	(5)
Marl	16	28,240	--------	--------	--------	--------	--------
Sand and gravel	1,167	2,365,456	--------	34	1,111	14.37	470
Sandstone	122	239,787	--------	23	(5)	95.92	(5)
1959							
Cement[4]	1,549	4,011,792	--------	6	(5)	1.49	(5)
Coal	3,707	5,973,788	4	267	39,058	45.36	6,538
Coke ovens	1,970	5,020,516	--------	15	(5)	2.99	(5)
Limestone[6]	2,931	5,759,304	3	199	(5)	35.07	(5)
Marl	23	24,870	--------	--------	--------	--------	--------
Sand and gravel	1,152	2,372,164	--------	27	907	11.38	382
Sandstone	123	268,182	--------	19	(5)	70.85	(5)

[1] Data exclude officeworkers; are final for 1958 and preliminary for 1959.
[2] Defined as the total number of injuries per million man-hours.
[3] Defined as the total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes quarries producing limestone used exclusively for manufacturing cement.

man-hours worked in the mineral industries in 1959 did not change appreciably from 1958, except in those affected by the 116-day steel strike. The principal decline was noted in the coke industry.

Eight fatalities were recorded, compared with nine in 1958. Besides fatalities shown in table 2, one fatal injury each year was reported in the clay industry in 1958 and 1959.

All employment and injury data for the mineral industry of the State were collected from companies on a voluntary basis. Data represents virtually complete reporting by cement, coal, and coke producers and by a high percentage of sand and gravel and stone operators.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—The Hindostan Whetstone Co. of Bedford manufactured sharpening stones from sandstone quarried near Orleans in Orange County.

Cement.—Four cement plants (Lehigh Portland Cement Co. at Mitchell, Lone Star Cement Corp. at Limedale, Louisville Cement Co. at Speed, and Universal Atlas Cement Co. at Buffington) produced portland and masonry cements. Shipments were slightly lower than in 1958. Stocks of portland cement at mills at yearend were 15 percent higher than in 1958. The average mill values of portland and masonry cements remained steady at $3.32 and $3.44 per barrel, respectively.

On February 10, rebuilding of the Mitchell plant of Lehigh Portland Cement Co. was begun. The first phase of the project was construction of two 11½- by 400-foot kilns to replace ten 125-foot kilns, part of the original installation built in 1906.

Over 3 million tons of limestone and large quantities of clay, shale, and slag were used in making cement. Over 341 million kilowatt-hours of electrical energy was used at the cement plants.

Clays.—Fire clay was produced in six counties and used for stoneware, floor and wall tile, architectural terra cotta, art pottery, firebrick and block, and heavy clay products.

Miscellaneous clay was mined in 22 counties. The material was used in heavy clay products (building and paving brick, draintile, sewer pipe), cement, lightweight aggregate, stoneware, and plastics.

The value of products manufactured from Indiana clay was estimated at $29.9 million by the Indiana Geological Survey.

TABLE 3.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Fire clay		Miscellaneous clays		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	471	$844	1,102	$1,301	1,573	$2,145
1955	529	1,021	1,200	1,917	1,729	2,938
1956	645	1,202	1,405	2,255	2,051	3,457
1957	398	748	1,077	1,821	1,475	2,569
1958	315	518	1,056	1,959	[1] 1,371	2,477
1959	366	565	1,326	2,350	1,692	2,915

[1] Revised figure.

Gypsum.—Gypsum was mined in Martin County by National Gypsum Co. and United States Gypsum Co. The crude ore was processed at mills adjacent to the mines and was used in manufacturing lath, wallboard, prepared plaster, and other products. Output was larger than in 1958.

During the year, National Gypsum Co. began a major expansion program at its Shoals operation. All plant facilities were being enlarged. Upon completion in 1960, mine production would be increased to provide material for increased plant capacity.

Mineral Wool.—Blast-furnace slag from Lake County steel mills was used for manufacturing mineral wool in plants in Madison, Starke, Wabash, and Wayne Counties.

Perlite.—Crude perlite, mined in Western States, was expanded at plants in Hammond (Lake County) and Scottsburg (Scott County). The processed material was used for building plaster, concrete aggregate, house-fill insulation, and industrial materials.

Roofing Granules.—Roofing granules were produced from natural slag in the Hammond area by H. B. Reed & Co., Inc.

Sand and Gravel.—Commercial production was reported from 67 counties by 183 producers.

County highway departments in nine counties reported production of sand and gravel, mostly for roads.

Major sand and gravel production came from Marion, St. Joseph, Vigo, Tippecanoe, Warren, and Allen Counties. The 10 leading producers, in alphabetical order, were: Allen-Whitley Gravel Co., Columbia City; American Aggregates Corp., Indianapolis; E. T. Burnside, Inc., Shelbyville; Irving Bros. Gravel Co., Inc., Marion; Irving Materials, Inc., No. 2, Fortville; Kickapoo Sand & Gravel Corp., Peru; Neal Gravel Co., Inc., Covington; Portage-Manley Sand Co., Rockton, Ill.; Standard Materials Corp., Indianapolis; and Western Indiana Gravel Co., Lafayette.

Demand for materials for building construction increased over 35 percent over 1958. Requirements for road materials increased 17 percent.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	345	$428	455	$646
Building	3,049	2,473	3,655	2,850
Paving	3,078	2,489	3,578	2,916
Engine	79	75	84	93
Filter	3	4	----------	----------
Railroad ballast	4	2	(1)	(1)
Fill	(1)	(1)	499	281
Other	23	18	(1)	(1)
Undistributed [2]	564	432	185	187
Total	7,145	5,921	8,456	6,973
Gravel:				
Building	2,782	2,995	4,297	4,370
Paving	4,802	4,835	5,882	5,528
Railroad ballast	433	346	280	207
Fill	1,093	612	999	623
Other	81	78	80	62
Total	9,189	8,865	11,538	10,790
Total sand and gravel	16,334	14,786	19,994	17,763
GOVERNMENT-AND-CONTRACTOR				
Sand:				
Paving	61	40	1	(3)
Total	61	40	1	(3)
Gravel:				
Building	47	19	----------	----------
Paving	420	200	318	145
Fill	----------	----------	44	16
Total	467	219	362	161
Total sand and gravel	528	259	363	161
ALL OPERATIONS				
Sand	7,206	5,961	8,457	6,973
Gravel	9,656	9,084	11,900	10,951
Grand total	16,862	15,045	20,357	17,924

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[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

[2] Includes fill (1958), glass, fire and furnace (1958–59), railroad ballast, and other construction and industrial sands (1959).

[3] Less than $1,000.

According to the Indiana State Highway Department, contracts awarded for road construction in 1959 were $48.3 million. This included 70.9 miles on the highway system, 59.8 miles on the interstate routes, and 155.7 miles of bituminous resurfacing. At yearend, there were 71 contracts in some phase of completion, totaling 350.7 miles, for which the total contract amount was $88.2 million. During 1959, the Indiana Bureau of Materials and Tests established a new laboratory for studying and testing bituminous-mix designs and special soil mechanics.

Stone.—Limestone and sandstone were quarried, and nearly all production (about 97 percent) was crushed for various uses, including cement manufacture, concrete aggregate and roadstone, filler, flux, railroad ballast, and agriculture.

Crushed limestone was produced in 40 counties. The largest output came from Clark, Putnam, Lawrence, Newton, Allen, and Pulaski Counties. Major producers included: Louisville Cement Co., May Stone & Sand, Inc., Mulzer Brothers, The Ohio & Indiana Stone Corp., and Standard Materials Corp.

Dimension limestone, quarried mainly in Lawrence and Monroe Counties, accounted for nearly 40 percent of the value of the limestone produced, although it represented only 3 percent of the output by weight. Most of the material was cut and finished by companies operating the quarries. Some was sold as rough architectural block. In the Bloomington-Bedford area, 14 independent finishing mills reported purchases of this material for fabrication into dressed stone. Leading producers of dimension limestone were: Indiana Limestone Co. and Ingalls Stone Co. (Bedford), Bloomington Limestone Corp., Empire Stone Co., B. G. Hoadley Quarries, Inc., and Victor Oolitic Stone Co. (Bloomington).

TABLE 5.—Limestone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Uses	1958		1959	
	Quantity	Value	Quantity	Value
Dimension: Building:				
Rough architectural (block)............cubic feet..	2,941	$2,967	2,719	$2,731
Dressed (cut and sawed)..........................do....	3,822	9,699	4,331	11,481
Flagging and rubble..............................do....	931	188	1,047	201
Total (approx. short tons) [1]....................	558	12,854	587	14,413
Crushed and broken:				
Riprap.....................................short tons..	51	87	42	50
Concrete aggregate, roadstone, etc.:				
Commercial.............................short tons..	9,916	12,559	13,000	16,659
Noncommercial..............................do....	-----------	-----------	13	14
Railroad ballast...................................do....	233	286	293	366
Agriculture..do....	2,304	3,047	1.917	2,665
Cement...do....	1,946	1,472	2,225	1,720
Other [2]...do....	252	719	337	874
Total commercial...............................do....	14,702	18,170	17,814	22,334
Total noncommercial..........................do....	-----------	-----------	13	14
Total crushed and broken..................do....	14,702	18,170	17,827	22,348
Grand total..do....	15,260	31,023	18,414	36,761

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[1] 145 pounds per cubic foot.

[2] Includes limestone for flux, chemicals, whiting or whiting substitutes, asphalt, fertilizer, dust for coal mines, filter beds, mineral food, mineral wool, and other miscellaneous uses (1958–59).

TABLE 6.—Production of calcareous marl

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1954	6	28,536	$18,515	1957	7	103,452	$65,011
1955	5	17,080	10,543	1958	7	60,196	39,637
1956	8	99,561	65,755	1959	8	62,589	39,979

Sandstone was produced in four counties. Except for one producer, who quarried quartzite for use in refractory materials, the companies produced sandstone for rough construction, rubble, sawed stone, and flagging. Sandstone was quarried by Indiana Sandstone Co., Inc., and Leonard Sandstone Co., Inc., in Lawrence County, Hinkle Sandstone Co. in Monroe County, and French Lick Sandstone Co., Inc., and Springs Valley Sandstone Co. in Orange County. General Refractories Co. quarried a quartz conglomerate in Martin County.

Calcareous marl was produced from pits in seven counties. The leading output came from Kosciusko, La Porte, and Elkhart Counties. The material was sold for soil conditioning.

Slag.—Blast-furnace slag was produced in Lake County as a byproduct of pig-iron production. It was used in making cement, mineral wool, and roofing granules, expanded for lightweight aggregate, and crushed for use as aggregate.

During the year, Vulcan Materials Co., one of the Nation's largest producers of building and construction materials, acquired the Gary Slag Corp., at Gary. The acquisition enabled the company to provide a wider range of construction materials in the Chicago area.

Sulfur.—Byproduct sulfur was recovered from crude petroleum at the Whiting refinery (Standard Oil Co. of Indiana). The Mathieson-Fluor process was used.

MINERAL FUELS

Coal.—Output decreased slightly from 1958, but the value of shipments was up because of an increase in price. Eighty mines were operated compared with 82 in 1958; production came from 45 strip and 35 underground mines. One large strip mine was still under development at yearend and two mines (one underground and one strip) were put into operation during the year. Over 10 million tons were shipped to consumers by rail, 2 million tons by water, and most of the remainder by truck. Small quantities were moved by tramways and conveyors. About 10.4 million net tons of coal were mechanically cleaned at 20 plants. Mining-equipment sales to Indiana coal producers included three mobile loading machines, two continuous miners, and two gathering and haulage conveyors. Nearly 98 percent of the underground output was mechanically loaded. Enos Coal Mining Co., Oakland City, installed thermal drying equipment and completed construction of raw-coal storage facilities.

All Maumee Collieries Co. operations were acquired by Alva Coal Corp. (a subsidiary of Peabody Coal Co.) December 1, 1959. Operations consisted of four mines in Greene, Owen, and Vigo Counties.

TABLE 7.—Bituminous-coal production, value, and number of mines operated in 1959, by counties

(Excluding mines that produce less than 1,000 short tons)

County	Production (short tons)			Total value	Number of mines operated	
	Underground	Strip	Total		Underground	Strip
Clay	3,391	896,566	899,957	$3,764,945	1	10
Dubois	21,063	----	21,063	88,729	4	----
Fountain	----	27,312	27,312	185,368	----	1
Gibson	495,909	----	495,909	2,229,493	2	----
Greene	9,102	1,518,093	1,527,195	6,662,955	2	6
Knox	654,137	471,559	1,125,696	4,383,284	2	2
Martin	----	31,429	31,429	139,738	----	1
Owen	----	(1)	(1)	(1)	----	2
Parke	----	(1)	(1)	(1)	----	2
Pike	66,890	1,960,306	2,027,196	7,906,260	4	6
Spencer	6,074	75,277	81,351	345,447	1	2
Sullivan	767,727	84,567	852,294	3,646,583	5	2
Vermillion	16,358	23,028	39,386	211,312	2	1
Vigo	2,218,040	(1)	(1)	(1)	5	2
Warrick	385,327	4,468,336	4,853,663	17,952,473	7	8
Undistributed	----	603,010	2,821,050	12,437,068	----	----
Total	4,644,018	10,159,483	14,803,501	59,953,655	35	45

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

The largest consumers of Indiana coal were the electric utility companies, who used nearly 60 percent of the output.

Coal was produced in 15 counties. Five counties (Greene, Knox, Pike, Vigo, and Warrick) each produced over 1 million tons and together accounted for over 80 percent of the State output.

Peat.—Peat was produced from bogs in Benton, Blackford, Grant, Marion, and Wells Counties.

TABLE 8.—Production of peat

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1950	5	5,793	$18,966	1955	6	9,053	$49,924
1951	5	5,699	22,824	1956	7	11,383	78,594
1952	9	10,115	49,775	1957	8	13,805	129,750
1953	6	6,919	41,049	1958	5	12,106	144,974
1954	8	12,041	59,149	1959	5	15,393	202,094

Petroleum and Natural Gas.—According to the Indiana Geological Survey, a total of 910 wells, excluding wells drilled for secondary recovery or gas storage, were completed, compared with 904 in 1958. Of the completed wells, 619 were field wells and 291 were wildcats. Drilling of field wells resulted in 293 oil producers, 14 gas producers, and 312 dry holes. The wildcats resulted in 11 new fields, 16 extensions, 5 new pays, and 259 dry holes. Secondary wells drilled totaled 103. Of these, 64 were water input or disposal wells, 15 were oil wells, 2 were dry holes, and 22 were gas storage wells.

In 1958 approximatey 35 percent of the oil produced in Indiana was by secondary recovery; in 1959 the figure was 33 percent. Fewer waterflood projects were begun, and many established floods had passed their peak of productivity.

Drilling was carried on in 37 counties; 779 of the completions were in Gibson (309 wells), Spencer (163 wells), Posey (91 wells), Pike (68 wells), Vanderburgh (48 wells), Perry (41 wells), Daviess (31 wells), and Warrick (28 wells) Counties.

Twenty-nine of the 32 successful exploratory wells were completed in rocks of the Mississippian, one in the Devonian, and two in the Ordovician. The discovery wells for the two most significant new pools, the Union Chapel East pool and the Degonia Springs North pool, were drilled in Spencer County and Warrick County, respectively. Discovery of the Degonia Springs North pool created new interest in exploration of an area in which little drilling had been done and all previously productive wells had been abandoned.

In Lawrence County the Indiana Farm Bureau Cooperative Association drilled the deepest test well to date in Indiana. This well was drilled into the Precambrian to a total depth of 6,806 feet and, although no oil or gas was found in the deeper horizons, much valuable information was obtained. The basement complex was reached at a depth approximately 1,500 feet greater than had been expected from data available for existing wells. The only other basement tests drilled in Indiana were six wells in Wayne, Henry, Jay, Howard, and Allen Counties, on the north and northwest flanks of the Cincinnati Arch. The favorable reservoir conditions and a slight show of oil in Silurian rocks encountered in the Lawrence County well were expected to encourage additional drilling in this area.

TABLE 9.—Production of crude oil, 1959, by major fields [1]

Field	County	Year discovered	Area (acres)	1959 production (barrels)	Number of wells, 1959	
					Producing	Completed
Caborn Consolidated	Posey	1940	1,660	339,659	133	2
College Consolidated	do	1941	660	152,402	55	1
Grandview	Spencer	1940	410	135,709	38	6
Griffin Consolidated	Gibson and Posey	1938	6,540	2,144,958	660	28
Heusler Consolidated	Posey and Vanderburgh	1938	1,450	121,242	86	2
Inman East	Posey	1943	360	275,743	31	0
Lamott Consolidated	do	1941	1,260	170,262	95	1
Mackey West	Gibson	1951	490	119,254	48	(2)
Macson Consolidated	do	1952	230	190,906	25	(2)
Mt. Carmel Consolidated	Gibson and Knox	1941	1,750	108,431	162	0
Mt. Vernon Consolidated	Posey	1941	1,970	364,023	163	3
Mumford Hills	Gibson and Posey	1940	790	140,441	60	5
Owensville Consolidated	Gibson	1940	1,630	288,351	142	0
Plainville	Daviess	1950	350	111,908	54	0
Powells Lake Consolidated	Posey	1955	430	135,322	44	(2)
Rock Hill (New)	Spencer	1953	430	107,859	29	0
Rockport East Consolidated	do	1958	460	134,327	29	(2)
Spencer Consolidated	Posey	1948	520	274,422	53	1
Springfield Consolidated	do	1946	2,300	819,498	274	(2)
Union-Bowman Consolidated (New).	Gibson, Knox, and Pike	1941	13,860	1,295,690	563	54
Vienna	Vanderburgh	1933	320	206,154	48	1
Welborn Consolidated	Posey	1941	1,500	208,215	132	1
Welborn North Consolidated	do	1953	300	105,932	24	5
Undistributed				3,603,292	2,525	800
Total				11,554,000	5,473	910

[1] Petroleum Section, Indiana Geological Survey.
[2] Data not available.

The Indiana Geological Survey studied and mapped the structural features in the area of the Lawrence County test well, and the results were published.[3]

The interest in shallow Chester beds as potential reservoirs continued and with new interest in deep testing was expected to maintain drilling activity at a steady rate.

During 1959 the Indiana Geological Survey issued Petroleum Exploration Maps for Steuben and Lagrange Counties. These maps were on a scale of 1 inch to 1 mile and showed well locations, total depths, and whether or not the wells were productive. Similar maps for 15 additional counties in northern Indiana were in preparation at the end of the year.

The proved oil reserve, as of December 31, 1959, was 73,951,000 barrels, and the total liquid hydrocarbon reserves was 74,075,000 barrels.[4]

METALS

Aluminum.—Aluminum Company of America resumed construction of its smelter in Warrick County. The Squaw Creek Coal mine, near Boonville, which was to supply fuel for the operation, was still under development.

Pig Iron and Steel.—Steel mills were operated at East Chicago by Inland Steel Co. and Youngstown Sheet and Tube Co., and at Gary by United States Steel Corp. On January 20 United States Steel Corp. placed in operation a large sintering plant for agglomerating iron ore. The facility is on an ore dock at the Gary Works. The sintered material was used in company blast furnaces.

National Steel Corp. announced plans for constructing a steel mill in the dunes area of Northern Indiana.

Data published by the American Iron and Steel Institute indicated that on January 1, 1960, the capacity of Indiana steel mills was 18,440,500 short tons of steel and the capacity of blast furnaces was 10, 324, 350 tons of pig iron. During the year blast-furnace capacity was increased by more than 600, 000 tons, and steel capacity remained unchanged. Indiana ranked third in the United States in blast furnace and steel capacity. In 1959 steel production totaled 11.6 million short tons, and pig iron production exceeded 6.6 million tons.

Due largely to the steel strike the output of steel decreased nearly 9 percent, and pig iron dropped over 15 percent from 1958 levels. In addition to iron ore, 5.1 million tons of coke, and 2.75 million tons of limestone and dolomite were consumed in the blast furnaces.

REVIEW BY COUNTIES

Mineral production was reported from all counties except Brown, Floyd, Franklin, Johnson, Ohio, Tipton, and Union. Production, valued at over $1 million, was reported from each of 21 counties; 47 percent of the State total came from six counties—Clark, Lake, Lawrence, Putnam, Vigo, and Warrick.

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[3] Melhorn, W. N., and Smith, N. M., The Mt. Carmel Fault and Related Structural Features in South-Central Indiana: Geol. Survey Rept. of Prog. No. 16, 1959, 29 pp.

[4] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, 1959, Reports on Proved Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada: 23 pp.

Adams.—The Krick Tyndall Co. of Findlay, Ohio mined clay from a pit near Decatur for use in manufacturing heavy clay products.

Limestone was quarried and crushed for road construction and agriculture by the John W. Karch Stone Co. near Bryant, and by Meshberger Bros. Stone Corp. at sites near Linngrove and Pleasant Mills. Road material was obtained from a sand and gravel pit near Geneva.

Allen.—May Stone & Sand, Inc., quarried limestone and mined sand and gravel near Fort Wayne. The materials were crushed and processed for use as building and road materials and for agriculture.

Clay mined near Grabill was used for manufacturing draintile by Klopfenstein Tile Works.

Sand and gravel pits and processing plants were operated at Fort Wayne by Paul C. Brudi Stone & Gravel Co., Inc., near Harlan by Irving Gravel Co., Inc., and at Roanoke by W. W. Gravel Co., Inc.

TABLE 10.—Value of mineral production in Indiana, by counties[1][2]

County	1958	1959	Mineral production in order of value[2]
Adams	$554,168	$525,033	Stone, clays, sand and gravel.
Allen	1,347,086	1,620,574	Stone, sand and gravel, clays.
Bartholomew	(3)	(3)	Stone, sand and gravel.
Benton	(3)	(3)	Peat, sand and gravel.
Blackford	(3)	(3)	Stone, peat, clays.
Boone	58,574	87,418	Sand and gravel.
Carroll	(3)	(3)	Stone, sand and gravel.
Cass	(3)	(3)	Do.
Clark	(3)	(3)	Cement, stone, sand and gravel, clays.
Clay	3,596,480	4,309,485	Coal, clays, sand and gravel.
Clinton	(3)	(3)	Sand and gravel.
Crawford	(3)	(3)	Stone.
Davies	144,429	(3)	Sand and gravel.
Dearborn	181,507	200,720	Do.
Decatur	(3)	(3)	Stone.
DeKalb	188,726	159,584	Sand and gravel.
Delaware	(3)	(3)	Do.
Dubois	146,900	138,317	Coal, clays, sand and gravel.
Elkhart	294,509	333,268	Sand and gravel, stone (marl).
Fayette	(3)	213,899	Sand and gravel.
Fountain	854,727	591,749	Sand and gravel, coal, clays.
Fulton	26,800	302,995	Sand and gravel, stone (marl).
Gibson	2,139,804	2,284,581	Coal, sand and gravel.
Grant	(3)	(3)	Stone, sand and gravel, peat.
Greene	6,647,306	6,840,450	Coal, clays, sand and gravel.
Hamilton	935,728	1,242,134	Stone, sand and gravel.
Hancock	42,376	57,463	Sand and gravel.
Harrison	142,250	243,787	Stone.
Hendricks	(3)	(3)	Sand and gravel.
Henry	127,895	137,067	Do.
Howard	(3)	(3)	Stone, sand and gravel.
Huntington	(3)	(3)	Stone, sand and gravel, clays.
Jackson	264,647	323,137	Clays, sand and gravel.
Jasper	(3)	(3)	Stone, sand and gravel.
Jay	79,068	92,440	Do.
Jefferson	------------	12,463	Sand and gravel.
Jennings	(3)	388,921	Stone.
Knox	5,205,674	4,713,794	Coal, sand and gravel.
Kosciusko	415,905	452,256	Sand and gravel, stone (marl).
Lagrange	(3)	(3)	Do.
Lake	(3)	(3)	Cement, clays, sand and gravel.
LaPorte	413,727	581,856	Sand and gravel, stone (marl).
Lawrence	11,459,307	12,632,531	Stone, cement.
Madison	739,092	1,102,805	Stone, sand and gravel.
Marion	(3)	(3)	Sand and gravel, peat.
Marshall	127,050	106,462	Sand and gravel.
Martin	(3)	2,907,913	Gypsum, stone, clays, coal.
Miami	515,653	430,338	Sand and gravel.
Monroe	7,600,680	8,818,858	Stone.
Montgomery	126,062	118,819	Clays, sand and gravel.
Morgan	741,130	1,144,412	Clays, sand and gravel, stone.
Newton	(3)	(3)	Stone, sand and gravel.
Noble	(3)	(3)	Sand and gravel, stone (marl).

See footnotes at end of table.

TABLE 10.—Value of mineral production in Indiana, by counties [1] [2]—Continued

County	1958	1959	Mineral production in order of value [2]
Orange	$839,905	$844,560	Stone, abrasives.
Owen	1,444,923	1,923,598	Stone, coal, sand and gravel, clays.
Parke	396,704	351,206	Sand and gravel, coal, clays.
Perry	(3)	(3)	Stone, clays.
Pike	8,301,692	7,906,260	Coal.
Porter	388,101	407,203	Sand and gravel, clays.
Posey	(3)	(3)	Sand and gravel.
Pulaski	(3)	(3)	Stone, clays, sand and gravel.
Putnam	(3)	(3)	Cement, stone, clays, sand and gravel.
Randolph	177,730	256,884	Stone, sand and gravel.
Ripley	500,370	462,299	Stone.
Rush	215,664	(3)	Stone, sand and gravel.
St. Joseph	567,221	722,473	Sand and gravel.
Scott	264,006	(3)	Stone.
Shelby	629,358	832,685	Stone, sand and gravel.
Spencer	(3)	387,773	Coal, sand and gravel.
Starke	67,500	31,991	Sand and gravel.
Steuben	(3)	114,130	Sand and gravel, stone (marl).
Sullivan	2,522,714	3,934,949	Coal, sand and gravel, stone.
Switzerland	91,184	80,500	Stone, sand and gravel.
Tippecanoe	(3)	(3)	Sand and gravel.
Vanderburgh	317,723	(3)	Clays.
Vermillion	1,450,030	720,503	Sand and gravel, coal, clays.
Vigo	12,650,375	12,273,811	Coal, sand and gravel, clays.
Wabash	38,971	125,911	Stone, sand and gravel.
Warren	(3)	(3)	Sand and gravel.
Warrick	17,458,576	18,139,473	Coal, stone, sand and gravel.
Washington	------	(3)	Stone.
Wayne	717,172	619,891	Sand and gravel, stone.
Wells	184,735	(3)	Stone, sand and gravel, peat.
White	350,000	325,200	Stone.
Whitley	(3)	(3)	Sand and gravel.
Undistributed	105,631,923	106,909,454	
Total [4]	197,677,000	207,701,000	

[1] The following counties did not report production: Brown, Floyd, Franklin, Johnson, Ohio, Tipton, and Union.

[2] Except for natural gas and petroleum production that was not available by counties. Value of these commodities is included with "Undistributed."

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Total adjusted to eliminate duplicating value of clays and stone.

Bartholomew.—In the Columbus area limestone was quarried by Meshberger Stone Co., Inc., and crushed for agriculture and road material. Driftwood Gravel Co., Inc., operated a sand and gravel pit and washing plant near Columbus.

Benton.—Millburn Peat Co., Inc., of Chicago, dug moss and humus peat from a bog near Otterbein. The output was used for soil improvement and horticulture. A pit near Fowler yielded road gravel.

Blackford.—Clay mined near Hartford City by Inman Tile Co. was used for manufacturing draintile and heavy clay products. Limestone was quarried and crushed near Montpelier by Montpelier Stone Co. The material was sold for use as asphalt filler, filter beds, and roadstone. In November the Montpelier Stone Co. was purchased by the J & K Stone, Inc., of Muncie.

Reed and sedge peat was dug from a bog near Hartford City by the Hartford Peat & Gravel Co.

Carroll.—Delphi Limestone Co. operated a quarry and crushing plant near Delphi. Roadstone and agricultural limestone were produced. Pits near Cutler and Flora yielded gravel for building and roads.

Cass.—The France Stone Co. of Toledo, Ohio operated the Keeport quarry and crushing plant and produced flux, railroad ballast, roadstone, and agricultural limestone. At Logansport the Cass County

Stone Co. quarried and crushed limestone for agriculture and roads. Sand and gravel was mined near Monticello and Logansport for building and highway use.

Clark.—At Speed, Louisville Cement Co. produced portland and masonry cements. The company mined clay and quarried limestone near the plant for use in manufacturing cement. Some of the limestone was sold for use in concrete aggregate and for roadstone. Limestone was quarried and crushed for agriculture, concrete aggregate, and roadstone near Jeffersonville by T. J. Atkins Co., Inc., at Sellersburg by Sellersburg Stone Co., and at Utica by the Louisville Sand and Gravel Co. Sand and gravel was produced at four sites.

Clay.—Coal was produced from 10 strip mines and 1 underground mine. The largest output was reported from the Chinook, Quality, and Old Hickory mines.

Fire clay and miscellaneous clay were mined at nine sites. A large share of the production was by coal-mining companies producing from underclays beneath lower Pennsylvanian coals. The clays were used or sold for manufacturing floor and wall tile, firebrick, heavy clay products, and cement. Road materials were obtained from a gravel pit near Carbon.

Crawford.—Limestone quarries were operated at Marengo by Hy-Rock Products Co. and near Eckerty by Mulzer Bros. The material was crushed and sold for agricultural limestone, railroad ballast, riprap, and roads.

Decatur.—Limestone quarries and crushing plants were operated at four sites. Most of the output was sold for agriculture and road materials. The largest production came from the Harris City Stone Corp., Greensburg, and New Point Stone Co. at New Point.

Dubois.—Coal was produced from four underground mines. Fire clay and miscellaneous clay were mined from two pits near Huntingburg for use in manufacturing art pottery, stoneware, and heavy clay products.

Sand and gravel was obtained from a pit near Jasper.

Elkhart.—Pits near Goshen and Etna Green yielded marl for soil conditioning. Sand and gravel was mined at five sites; most was used for building or roads.

Fountain.—The Morgan Coal Co. operated the Kingman strip mine. Clay was mined at three pits and used in manufacturing building brick and molded plastics. Sand and gravel was produced at two pits.

Fulton.—Marl was produced from a pit near Kewanna by M. E. Zellers. Four sand and gravel pits in the Rochester area yielded building and road materials.

Gibson.—Underground coal mines were operated by the Princeton Mining Co. and the Somerville Coal Co.

Sand and gravel was produced at three pits.

Grant.—Glacier Peat Moss Co. dug peat from a bog near Jonesboro. The Pipe Creek Stone Co. operated a quarry and crushing plant near Mier. Output included flagging, riprap, fluxstone, roadstone, railroad ballast, and agricultural limestone. Sand and gravel was mined and processed at two sites near Marion.

Greene.—Coal was produced from six strip and two underground mines. The Airline and Linton mines, formerly operated by Maumee Collieries Co., were sold to the Alva Coal Corp., a subsidiary of Peabody Coal Co.

Bloomfield Brick Co., Inc., mined miscellaneous clay for manufacturing building brick. Comet Collieries, Inc., produced fire clay from its Comet strip mine near Switz City. The clay was sold for manufacturing firebrick. Sand and gravel was produced at two pits near Bloomfield.

Hamilton.—The Stony Creek Stone Co., Inc., quarried and crushed limestone near Noblesville for agriculture, concrete aggregate, and roadstone. Sand and gravel was produced at seven sites.

Harrison.—Three limestone quarries were operated near Corydon by Corydon Crushed Stone & Lime Co. and at Depauw by Mathes Stone Quarry and Davis Crushed Stone & Lime Co. The output was crushed and sold for agriculture and road materials.

Howard.—The Yeoman Stone Co. operated a limestone quarry near Kokomo. Part of the output was sold for house stone veneer and flagging. The remainder was crushed for road material and agricultural limestone. A sand and gravel pit near Tipton yielded building and road materials.

Huntington.—Material for draintile was obtained from clay pits near Majenica (Majenica Tile Co.) and Simpson (Simpson Clay Works). The Erie Stone Co. of Toledo, Ohio operated a quarry and crushing plant at Huntington. Output was sold for fluxstone, concrete aggregate and roadstone, agricultural limestone, railroad ballast, and mineral wool. A sand and gravel pit near Andrews yielded building and paving materials.

Jackson.—Miscellaneous clay was mined at Ewing by Jackson Brick & Hollow Ware Co., near Brownstown by Lehigh Portland Cement Co., and at Medora by Medora Brick Co. The material was used for building brick, cement, and heavy clay products. Sand and gravel was produced at two pits.

Jasper.—Limestone was quarried and crushed at Rensselaer by W. C. Babcock Construction Co., Inc. Agricultural limestone, roadstone, and washed aggregates were produced. Building and paving materials were obtained from a sand and gravel pit near Rensselaer.

Jay.—Rockledge Products, Inc. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural limestone at Portland. Road materials were obtained from a sand and gravel pit near Bluffton.

Jennings.—Paul Frank, Inc., operated a limestone quarry and plant at North Vernon. Output was sold for roads and agriculture.

Knox.—Coal was produced from two strip mines and two underground mines. The Knox strip mine operated by the Youngs Construction Co., Inc., was abandoned in December. Sand and gravel was mined from three pits near Vincennes.

Kosciusko.—Marl for agriculture was produced at three sites in the county. Six sand and gravel pits yielded building and road materials. From one of these pits, near Syracuse, engine sand also was produced.

Lagrange.—Glen Hesher operated a marl pit near Howe. Building and paving materials were obtained from four sand and gravel pits.

Lake.—Universal Atlas Cement Co. produced portland and masonry cements at Buffington. The National Brick Co. of Chicago mined clay for building brick from a pit near Munster. Industrial sands were produced by John N. Bos Sand Co., Chicago, Ill., at a pit near Gary. Byproduct sulfur was recovered from crude petroleum at the Standard Oil Co. refinery at Whiting. Roofing granules were manufactured from slag at Hammond by H. B. Reed Co., Inc.

The Gary Slag Corp., producer of railroad ballast, slag for concrete, and lightweight aggregate, was purchased by Vulcan Materials Co.

Pig iron and steel were produced at Gary by U.S. Steel Corp., and at East Chicago by Inland Steel Co. and Youngstown Sheet & Tube Co.

Refractories were produced at Gary by General Refractories Co., Inc., and at East Chicago and Hammond by Harbison-Walker Refractories Co.

La Porte.—The area was an important source of industrial sands (engine, glass, molding) as well as materials for building and roads. Production was reported from five sites. A pit near Walkerton yielded marl for agriculture.

Lawrence.—The Bedford area had been noted for its fine building stone for many years. Dimension limestone was quarried and milled by Heltonville Limestone Co., Indiana Limestone Co., and Ingalls Stone Co. Limestone, purchased from quarries in rough blocks, also was fabricated into building stone at mills in the area. Indiana Limestone Co. had established a stone "supermarket" at Oolitic, where 15 acres (5 acres for mill blocks and 10 acres for veneer stone) were utilized for displaying and selling building stone. Customers could select the exact variety of stone required. The stone was sold on a spot-delivery basis, and company fork-lift trucks loaded the material on the customer's vehicle. Purchases varied from small bundles of veneer to 10-ton blocks. The Bedford Ground Limestone Co. crushed and ground spalls from stone mills for mineral food, glass manufacture, and agriculture.

Limestone was quarried and crushed for use as fluxstone, concrete aggregate and roadstone, railroad ballast, and agricultural limestone by Mitchell Crushed Stone Co., Inc., Oolitic Ground Limestone Co., and Ralph Rogers & Co., Inc.

Sandstone was quarried and finished for building stone by Indiana Sandstone Co., Inc., and Leonard Sandstone Co., Inc.

Portland and masonry cements were produced at Mitchell by Lehigh Portland Cement Co. The company also produced limestone for use in manufacturing cement. Construction was started early in the year on two 11½-foot by 400-foot kilns to replace ten 125-foot kilns which were part of the original plant.

Madison.—Standard Materials Corp. of Indianapolis operated the Lapel quarry and produced crushed limestone for roads and agriculture. Sand and gravel was mined from four pits.

Marion.—Peat-Moss, Inc., dug reed, sedge, and humus peat from a bog near Indianapolis. Several large sand and gravel pits and processing plants were operated in the Indianapolis area. The material was used locally for highway and building construction. The Indiana

Cut Stone Corp. purchased rough limestone blocks and milled them for building.

Martin.—Coal was produced from a strip mine by P. & R. Coal Co.

General Refractories Co. mined a deposit of quartz conglomerate near Shoals. The material was crushed and shipped to company plants for use in manufacturing refractories.

Loogootee Clay Products Corp. mined clay near Loogootee for use in manufacturing heavy clay products.

Gypsum mines and processing plants were operated near Shoals, by National Gypsum Co. and United States Gypsum Co.

Monroe.—Limestone for building was produced from quarries operated by Ed. Bennett Stone Co., Bloomington Limestone Corp., Empire Stone Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Indiana Limestone Co., Ingalls Stone Co., Midwest Quarries, Inc., Victor Oolitic Stone Co., Texas Quarries, Inc., and Woolery Stone Co., Inc. Most of the large quarry operators fabricated the stone at their own mills in the Bloomington and Bedford areas. Several independent mills fabricated purchased stone for building. Indiana Calcium Corp. operated a fine-grinding plant in Bloomington and produced filler for several industrial uses and coal-mine dust as well as agricultural limestone, concrete aggregate, and roadstone. Spalls, purchased from stone mills, was the raw material used.

Bloomington Crushed Stone Co. quarried and crushed limestone, mainly for concrete aggregate, roadstone, and agriculture. Hinkle Sandstone Co. produced flagging and sawed stone.

Montgomery.—In the Crawfordsville area, clay was mined by American Vitrified Products Co. and Hydraulic-Press Brick Co. The material was used in manufacturing building brick and sewer tile. Sand and gravel was mined at four sites in the county.

Morgan.—In the Brooklyn area clay was mined by the Brooklyn Brick Co., the Indiana Drain Tile Co., and the Hydraulic-Press Brick Co., and at Martinsville by Adams Clay Products Co. The material was used in manufacturing building brick, draintile, and heavy clay products. Clayton Winders & Sons, of Spencer, quarried and crushed limestone for concrete aggregate, roadstone, and agriculture. Sand and gravel for building and paving was obtained from five pits.

Newton.—Newton County Stone Co., Inc., operated a limestone quarry near Kentland. The material was crushed for agriculture and roads. A sand and gravel pit near Morocco yielded building and paving material.

Noble.—Marl was dug from a pit near Albion by Luther & Haney. Five sand and gravel pits were operated in the county.

Orange.—Near Orleans whetstones were quarried by Hindostan Whetstone Co. Limestone was quarried and crushed at Paoli by Calcar Quarries, Inc., at French Lick by William Cave Stone Co., and at Orleans by Radcliff & Berry, Inc. Sandstone for building was produced by Springs Valley Sandstone Co., West Baden. French Lick Sandstone Co., Inc., operated a mill at French Lick for finishing sandstone quarried in Lawrence and Martin Counties.

Owen.—Coal was produced from two strip mines. Fire clay from the Old Glory No. 33 strip mine was sold to manufacturers of heavy clay products, art pottery, and terra cotta.

Limestone for building was quarried by Ingalls Stone Co. and milled at the company plant in Bedford. Limestone was quarried and crushed by Dunn Limestone Co., Inc., Gordon & Shepard Stone Co., and Clayton Winders & Sons. The output was sold for flux, railroad ballast, road material, and agriculture. Sand and gravel was produced at three sites.

Parke.—S. L. Turner Coal & Clay Co. mined coal and fire clay from the Turner strip mine. Maple Grove Coal Co. operated a strip mine. Cayuga Brick & Tile Co. mined clay near Bloomingdale for use in manufacturing heavy clay products. A sand and gravel pit near Montezuma yielded materials for railroad ballast, building, and roads.

Perry.—U.S. Brick Co. mined clay near Tell City for use in fabricating building brick. Mulzer Bros. operated a limestone quarry and crushing plant at Derby. The output was sold for agriculture and roads.

Pike.—Coal was produced from six strip mines and four underground mines. One of the two strip mines operated by the Ayrshire Collieries Corp. was closed in June.

Porter.—Chas. H. Schrock produced clay near Chesterton. J. S. Robbins discontinued operation of a clay pit at McCool. A considerable amount of industrial sand was produced at four pits in the dunes area of the county.

Pulaski.—Clay mined near Francesville was used in manufacturing heavy clay products by Francesville Drain Tile Corp. In the same area, limestone was quarried and crushed by Francesville Stone Co., Inc. Sand and gravel was produced near Monterey.

Putnam.—Lone Star Cement Corp. produced portland and masonry cements at Limedale. The company mined clay and quarried limestone locally for its own use. Limestone quarries and crushing plants were operated by Ohio & Indiana Stone Corp. and Russellville Stone Co. Manhattan Crushed Stone Co. operated its quarry and plant until May 15, when the property was purchased by Standard Materials Corp.

The Indiana State Farm operated a clay pit and limestone quarry near Putnamville for its own use. Sand and gravel was produced near Pleasant Gardens.

Randolph.—H. & R. Stone Co. operated a limestone quarry and crushing plant near Ridgeville. Four sand and gravel pits yielded building and paving materials and railroad ballast.

Ripley.—Limestone quarries and crushing plants were operated in the Versailles area by Cord Stone Co. and Paul Frank, Inc., at New Point by New Point Stone Co., and at Osgood by Southeastern Materials Corp. A certificate of achievement in safety was awarded to Southeastern Materials Corp. by the Federal Bureau of Mines for operating the Semco quarry without sustaining a disabling injury in 1959.

Rush.—Limestone was quarried and crushed near Milroy by McCorkle Stone Co. and near Moscow by Rush County Stone Co. Sand and gravel was produced at two pits.

Scott.—Limestone was quarried near Scottsburg by the Scott County Stone Co. Standard Materials Corp. operated the Hanover quarry.

The output was crushed for agriculture, concrete aggregate, and road material.

Shelby.—Limestone was quarried for riprap, flux, railroad ballast, agriculture, and road materials near Morristown (Cave Stone Co., Inc.) and St. Paul (St. Paul Quarries, Inc.). Sand and gravel was produced in the Shelbyville area.

Spencer.—Coal was produced from two strip mines and one underground mine. At Richland, Hardy Sand Co. of Evansville produced molding sand.

Steuben.—Agricultural marl was dug from pits near Fremont and Hudson. Sand and gravel was produced at six sites.

Sullivan.—Coal was produced at two strip and five underground mines.

The Thunderbird mine (underground) began operations in February, and the Hoosier Gem strip mine began producing in June. Coal from the Hoosier Gem mine was cleaned at the Fairview Collieries Corp. Minnehaha mine.

Kixmiller Bros. operated a limestone quarry near Freelandsville. Sand and gravel was produced at three pits.

Switzerland.—Tri-County Stone Co. operated a limestone quarry and crushing plant in the northwestern corner of the county. The material was used for concrete aggregate, roadstone, and agriculture. Road gravel was produced at one site.

Vanderburgh.—Standard Brick & Tile Co. mined clay near Evansville for its own use. Sand and gravel dredged from the Ohio river was processed at plants of the Bedford-Nugent Co. of Evansville.

Vermillion.—Coal was produced from one strip mine. The Sunspot strip mine, operated by Ayrshire Collieries Corp., was abandoned in February.

Fire clay was mined from the Dana pit near Newport by Arketex Ceramic Corp. It was used in manufacturing ceramic glazed structural tile. Cayuga Brick Corp. mined miscellaneous clay for its own use near Cayuga. Sand and gravel was produced at three sites.

Vigo.—Coal was produced from two strip and five underground mines. The Talleydale underground mine of the Snow Hill Coal Corp. was abandoned in June. The Terre Haute Vitrified Brick Works, Inc., produced miscellaneous clay for its own use at Terre Haute. Sand and gravel was produced at five pits.

Wabash.—Mill Creek Stone Co. operated a limestone quarry and crushing plant in the Wabash area. Several sand and gravel pits yielded building and paving materials.

Warrick.—Coal was produced from seven underground and eight strip mines. The Squaw Creek mine of the Peabody Coal Co. was still under development. In July, the name of the Houston Coal Mining Co., operator of the Houston No. 2 (underground) mine, was changed to the C. & H. Coal Co., Inc.

Lemmons & Co., Inc., Boonville, operated a limestone quarry and crushing plant. Concrete aggregate and roadstone was produced. A subsidiary of the company (Midwest Sand & Gravel) operated a dredge on the Ohio river near Boonville and produced sand and gravel for building and paving.

Washington.—Hoosier Lime & Stone Co. operated a limestone quarry and crushing plant at Salem for producing building and road materials.

Wayne.—DeBolt Stone Quarry, at Richmond, produced material for riprap, concrete aggregates, roadstone, and agriculture. Sand and gravel was produced at six sites.

Wells.—Moss peat was dug from a bog near Warren by Ballards Peat Moss.

Limestone was quarried and crushed for flux, concrete aggregate, roadstone, and railroad ballast by the Erie Stone Co. at Huntington. Heller Stone Co. produced crushed stone near Bluffton. Sand and gravel was produced in the Bluffton Area.

White.—Monon Crushed Stone Co., Inc., operated a limestone quarry and crushing plant at Monon. The material was used for agriculture, railroad ballast, and roadstone.

The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Iowa.

By Samuel A. Gustavson [1]

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MINERAL production from Iowa was valued at $88.6 million in 1959, a 4-percent increase over 1958 and a new record for the State. The value of Iowa's mineral output has increased each year since 1953.

Clay, gypsum, limestone, and sand and gravel were Iowa's principal mineral products. Production of these minerals has trended upward for a number of years. A major factor in production gains in 1959 was the continued high levels of building and highway construction. Output of coal, which had trended downward for a number of years, was about the same in 1959 as in 1958. The State was the principal market for its own mineral products; however, gypsum, cement, and peat had a sizeable market in adjacent States. Some heavy clay products also were sold, chiefly in the Chicago, Ill., area.

TABLE 1.—Mineral production in Iowa [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland .... 376 pound barrels	12,260	$39,993	12,701	$42,081
Masonry .... do	415	1,748	469	1,967
Clays [2]	837	1,054	911	1,168
Coal [3]	1,179	4,147	1,180	4,214
Gypsum (crude)	1,230	4,491	1,318	5,587
Sand and gravel	12,411	10,965	13,484	11,658
Stone	21,045	26,138	20,501	25,759
Value of items that cannot be disclosed: Other nonmetals		633		520
Total Iowa [4]		85,356		88,557

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay (1958) included with "Value of items that cannot be disclosed."
[3] Exclusive of mines producing less than 1,000 short tons.
[4] Total has been adjusted to eliminate duplicating the value of clay and stone.

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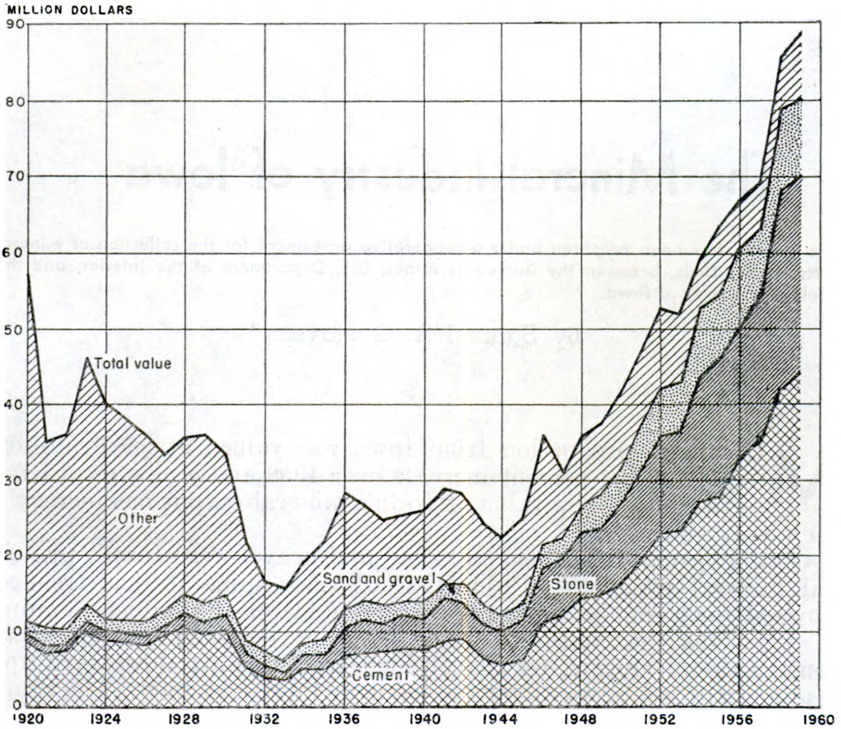

FIGURE 1.—Value of cement, stone, and sand and gravel, and total value of mineral production in Iowa, 1920–59.

Employment and Injuries.—Data shown in Table 2 represent 100 percent coverage for each industry, with full reporting by all companies in the cement, coal, and gypsum industries. Labor data for the clay, sand and gravel, and stone industries are partially estimated.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Production and sales of cement continued to increase, following a trend that began in 1944. Production in 1959 was about 7 percent greater than in 1958. In general, this upward trend followed the growth in highway construction and continued strong demand in the building industry. Five cement plants were active, two in Cerro Gordo County, two in Polk County, and one in Scott County. Plants within the State have 27 kilns, ranging in size from 110 feet in length by 7 feet in diameter to 475 feet in length by 11 feet 6 inches in diameter. Except for repairs and unavoidable shutdowns, kilns operated continuously during the year. All plants produced types of I and II, general-use and moderate-heat cements; type III, high-early-strength; and air-entrained cement. Masonry cements were produced at four plants.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Iowa [1]

Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number days lost or charged	Injury-frequency rate [2]	Injury-severity rate [3]
			Fatal	Nonfatal			
1958							
Cement [4]	992	2,691,581	1	1	(5)	.74	(5)
Clay [6]	444	950,419	----------	43	319	45.24	336
Coal	532	846,720	1	32	7,282	38.97	8,600
Gypsum	346	778,985	----------	1	55	1.28	71
Limestone [7]	1,451	2,921,497	----------	94	(5)	32.18	(5)
Sand and gravel	1,111	2,136,906	----------	65	1,162	30.42	544
1959							
Cement [4]	1,069	2,736,112	----------	3	(5)	1.10	(5)
Clay [6]	395	744,882	----------	22	729	29.53	979
Coal	526	840,160	2	29	13,042	36.90	15,523
Gypsum	481	1,195,546	----------	5	129	4.18	108
Limestone [7]	1,502	3,107,374	1	62	(5)	20.27	(5)
Sand and gravel	799	1,612,944	----------	24	694	14.88	430

[1] Data exclude office workers; are final for 1958 and preliminary for 1959.
[2] Defined as the total number of injuries per million man-hours.
[3] Defined as the total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement.
[5] Data not available.
[6] Excludes pits producing clay used exclusively in manufacturing cement.
[7] Excludes quarries producing limestone used exclusively in manufacturing cement and lime.

Plant capacity was slightly over 14 million barrels per year. No new kilns were added in 1959.

Sales of portland cement rose about 4 percent in quantity and 5 percent in value over 1958. Sales of masonry cements increased about 13 percent in quantity and value. Unit prices per barrel, f.o.b. mill, after cash discounts and excluding cost of containers, averaged $3.31 per barrel compared with $3.26 per barrel in 1958. Masonry cements averaged $4.19 per barrel compared with $4.22 per barrel in 1958. The cements produced were marketed chiefly in Iowa and Minnesota; appreciable quantities also were sold in Illinois and Wisconsin and small quantities in Nebraska, North Dakota, and South Dakota. On December 31, stocks of cements in plants within the State totaled 1,565,000 barrels compared with stocks on January 1, 1959, of 1,243,000 barrels. Virtually all cement was shipped by rail. About 78 percent of the cement was shipped in bulk and 22 percent in bags.

Clays.—Iowa clays and shales were mined chiefly for making heavy clay products, such as common brick, building tile, and sewer or drain tile, or for manufacturing cement. A small tonnage of clay classed as fire clay was produced in Keokuk County by John Nelson & Sons. Three companies sold small quantities (less than 1 percent of the raw clay was sold); other companies used their own output. A few hundred tons of clay was used for mortar mix, but about 54 percent of the total output was used in cement manufacture and 45 percent in manufacturing heavy clay products. In 1958, about 52 percent of the total output was used in cement and 48 percent in heavy clay products.

Shale or clay pits were operated by 26 firms in 16 counties. The bulk of the output came from pits in Cerro Gordo, Dallas, Madison, Polk, Scott, and Webster Counties. Heavy clay products are chiefly farm drain tile and building tile. The market for farm drain tile depends on the availability of Government funds to absorb part of the cost and on the apparent need, which an especially wet year will accentuate.

Gypsum.—Iowa ranked fourth in the Nation as a producer of gypsum. All production came from mines in Webster County. Four companies, each with processing plants, mined gypsum and manufactured products which included base-coat plasters, ready-mixed and other special-use plasters, gypsum lath, wallboard, sheathing, tile, other preformed items, and pulverized gypsum. Most of the products were used in the building industry, in agriculture, as a portland-cement retarder, and as a filler. Relatively small quantities were used in the glass and pottery industry, for art moldings and castings, in dental and orthopedic plaster, and for other uses.

Demand for gypsum increased over 1958, and output nearly equaled the record tonnage output of 1955. The value of gypsum products exceeded that of 1955 by nearly $1.5 million. The estimated unit value of crude gypsum was $4.24 per ton, compared with $3.65 per ton in 1958 and $3.12 per ton in 1955.

The United States Gypsum Co. continued developing a gypsum mine and building a processing plant about 15 miles north of Burlington near Sperry. The mine and plant were expected to be operating early in 1960. The gypsum deposit is flat lying and at a depth of about 600 feet.

Lime.—The Linwood Stone Products Co., Inc., in Buffalo, near Davenport, Scott County, was the only producer of quicklime and hydrated lime reported for the State. Production was slightly less than in 1958. The raw material used was high calcium limestone. The products were sold chiefly for use in open-hearth furnaces, water-purification processes, sewage and trade-waste treatment, and as mason's lime. A small tonnage of lime (65 tons) was produced as a byproduct of water treatment at the Marshalltown Water Works in Marshalltown. The plant had a flash kiln with an annual lime-burning capacity of 900 tons. Operation of this plant was discontinued during the year.

Perlite.—Crude perlite from Colorado and Nevada was expanded in plants operated by each of the four gypsum producers in Webster County. The entire output reportedly was used in lightweight plaster, chiefly premixed.

Sand and Gravel.—Sand and gravel sold or used from Iowa deposits increased about 9 percent in tonnage and 6 percent in value over 1958. Continued demand for sand and gravel in highway and building construction was the chief reason for the increased output. Although the percentage of tonnage increase exceeded the percentage of value increase, indicating a lower unit price than in 1958, prices for specific types of sand and gravel were virtually unchanged or slightly higher. However, the ratio production of high-value material to total output was less than in 1958. Competition was the major factor in holding unit prices relatively stable.

The unit value of sand produced in Iowa was in most instances less than the unit value for gravel. The State has limited sand and gravel deposits and usually there is an excess of sand in these deposits. As a result, the State was an importer of gravel.

Some sand for use as engine and filter sand was produced in the State. Foundry sand was produced in Clayton County.

About 3 percent of the commercial sand and 7 percent of gravel output were sold as unwashed pit-run material, principally for use as fill. Commercially produced sand and gravel was hauled by truck (94 percent) and by rail (6 percent). Virtually all noncommercial sand and gravel was hauled by truck.

TABLE 3.—Sand and gravel sold or used by producers by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	2,104	$1,824	2,494	$2,226
Paving [1]	1,541	1,401	1,376	1,254
Railroad ballast	45	19	(2)	(2)
Fill	338	179	352	190
Other	19	20	13	8
Undistributed [3]	145	366	121	286
Total	4,193	3,809	4,356	3,964
Gravel:				
Building	1,501	2,108	1,416	2,026
Paving [1]	4,290	3,661	5,314	4,206
Railroad ballast	101	65	(2)	(2)
Fill	111	48	204	127
Other	30	125	(2)	(2)
Undistributed	-----	-----	86	236
Total	6,033	6,007	7,020	6,595
Total sand and gravel	10,226	9,817	11,376	10,559
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving [1]	155	96	185	78
Gravel:				
Building	67	33	-----	-----
Paving [1]	1,963	1,020	1,883	1,009
Fill	-----	-----	41	12
Total sand and gravel	2,185	1,149	2,109	1,099
ALL OPERATIONS				
Sand	4,348	3,905	4,540	4,042
Gravel	8,063	7,060	8,944	7,616
Total	12,411	10,965	13,484	11,658

[1] Includes materials used in bridges, culverts, etc.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Value of items that cannot be disclosed: Molding, blast, engine, filter, and other industrial sands (1958–59).

The 10 leading producers, several operating in two or more areas of the State, in alphabetical order, were:

Acme Fuel & Material Co., Muscatine.
Concrete Materials & Construction Division, American Marietta Co., Cedar Rapids.
Coon Valley Gravel Co., Des Moines.
Elmer Dole, Irvington.
L. G. Everist, Inc., Sioux Falls, S. Dak.
Hallett Construction Co., Crosby, Minn.
Keefner Sand & Gravel Co., Des Moines.

Maudlin Construction Co., Webster City.
Mauer Construction Co., Sac City.
Northern Gravel Co., Muscatine.

Stone.—All stone produced in Iowa in 1959 was limestone, excepting some friable sandstone. Data for sandstone are covered in statistics on sand and gravel in this chapter.

Production and sales of limestone continued at a high level but total output was about 3 percent under that of 1958, the record year. Some dimension limestone was produced in Jones County, primarily for use as veneer on houses, and as flagstone. Crushed limestone was produced in many counties chiefly for roadstone, concrete aggregate, or agricultural use. Several plants in the State specialized in sized limestone and would supply stone to meet virtually any specification of size or mixed sizes. One of the more important markets for specially sized limestone was poultry grits.

The 10 leading producers of limestone, listed alphabetically, were:

Concrete Materials & Construction Division, American Marietta Co., Cedar Rapids.
B. L. Anderson, Cedar Rapids.
Dewey Portland Cement Co., Kansas City, Mo.
Kaser Construction Co., Des Moines.
Linwood Stone Products Co., Inc., Davenport.
Marquette Cement Manufacturing Co., Chicago, Ill.
Missouri Valley Limestone Co., Oakland.
Penn-Dixie Cement Corp., Nazareth, Pa.
E. I. Sargent Quarries, Inc., Des Moines.
Weaver Construction Co., Iowa Falls.

TABLE 4.—**Limestone sold and used by producers, by uses**

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
Commercial:				
Agriculture	1,630	$2,223	1,359	$1,878
Dimension	10	82	8	74
Fluxing stone	41	64	34	52
Railroad ballast	7	11	(1)	(1)
Riprap	308	385	156	200
Concrete aggregate, roadstone, etc	14,875	18,374	14,354	18,091
Cement	3,231	3,500	3,602	3,795
Other [2]	247	894	256	956
Total	20,349	25,534	19,769	25,046
Noncommercial, all uses (concrete aggregate, roadstone, riprap)	696	604	732	713
Grand total	21,045	26,138	20,501	25,759

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."
[2] Includes limestone for chemical uses (1958), stone sand (1959), asphalt filler, fertilizer, dust for coal mines, filter beds, poultry grit, mineral food, lime, and other uses (1958–59).

MINERAL FUELS

Coal.—Production of coal from Iowa mines was virtually the same as that in 1958. Output was from 22 underground and 32 strip mines in 10 counties. The average value was reported at $3.57 per ton, compared with $3.52 per ton in 1958. Prices ranged from $2.48 to $6.00 per ton. All output was sold on the open market and was transported by rail (63 percent) and truck (37 percent). Virtually all Iowa coal was consumed within the State, about 59 percent by electric utilities, 5 percent by retail dealers, and 36 percent by all other uses—chiefly heating for State, county, and local municipal buildings or institutions. Overburden in the strip mines ranged from 18 to 45 feet. The thickness of overburden at 11 mines was 18 to 30 feet, at 6 mines 30 to 40 feet deep, and at 6 other mines 40 to 50 feet. Only 3 of a total of 56 coal-mining companies employed more than 20 men in their mining operations.

TABLE 5.—Bituminous-coal production, value, and number of mines operated in 1959, by counties

(Exclusive of mines producing less than 1,000 short tons)

County	Production (short tons)			Total value	Number of mines operated	
	Underground	Strip	Total		Underground	Strip
Appanoose	61,229	18,119	79,348	$384,090	10	1
Keokuk	----------	1,930	1,930	10,615	----------	1
Lucas	36,589	4,488	41,077	184,982	1	1
Mahaska	----------	225,956	225,956	811,926	----------	8
Marion	80,897	601,034	681,931	2,276,949	4	12
Monroe	46,446	35,469	81,915	283,488	6	3
Polk	----------	1,519	1,519	5,664	----------	1
Van Buren	----------	17,094	17,094	79,413	----------	1
Wapello	3,583	43,150	46,733	168,067	1	3
Warren	----------	2,397	2,397	8,941	----------	1
Total	228,744	951,156	1,179,900	4,214,135	22	32

Peat.—Peat was produced by two companies from bogs in Worth and Winnebago Counties.

REVIEW BY COUNTIES

Of the 99 counties, mineral output was reported from all but Davis, Grundy, Ida, Iowa, Page, Ringgold, Shelby, and Wayne. Probably, some limestone or sand and gravel was produced in these counties, because several companies reporting production of these minerals did not submit a breakdown showing output by county of origin. Data were submitted by 110 commercial and 28 noncommercial producers of sand and gravel and 92 commercial and 10 noncommercial producers of limestone. Estimates were made for a few nonreporting companies producing these commodities, based on previous reports and other sources of information.

Production of sand and gravel was reported from 68 counties and limestone from 61 counties. Sand and gravel output increased over 1958, but limestone output declined slightly.

Appanoose.—Bituminous coal was produced at 10 underground mines and 1 strip mine. New producers during the year were Big Five Coal Company, operating an underground mine, and Kirkville Coal Co., operating a strip mine. The county's largest producer was again Sunshine Coal Co. Most of the coal was shipped by truck and a small quantity by rail. Coal seams mined in this county averaged 30 to 36 inches thick.

TABLE 6.—Value of mineral production in Iowa, by counties [1]

County	1958	1959	Minerals produced in 1959 in order of value
Adair	$690,634	(2)	Stone.
Adams	(2)	(2)	Do.
Allamakee	122,707	$82,869	Stone, sand and gravel.
Appanoose	866,380	829,398	Stone, coal, clays.
Audubon	-----------	408	Sand and gravel.
Benton	26,650	52,075	Sand and gravel, stone, clays.
Black Hawk	903,670	815,737	Stone, sand and gravel.
Boone	270,406	190,810	Sand and gravel, clays.
Bremer	(2)	499,355	Stone, sand and gravel.
Buchanan	50,000	49,280	Stone.
Buena Vista	33,178	53,721	Sand and gravel.
Butler	280,524	338,717	Stone, sand and gravel.
Calhoun	30,159	76,829	Sand and gravel.
Carroll	49,847	150,392	Do.
Cass	47,157	(2)	Stone, sand and gravel.
Cedar	(2)	(2)	Stone.
Cerro Gordo	20,383,781	22,689,740	Cement, stone, clays, sand and gravel.
Cherokee	46,146	87,001	Sand and gravel.
Chickasaw	(2)	(2)	Stone, sand and gravel.
Clarke	184,942	(2)	Stone.
Clay	144,006	103,930	Sand and gravel.
Clayton	(2)	40,028	Stone.
Clinton	(2)	(2)	Stone, sand and gravel.
Crawford	109,543	113,528	Sand and gravel.
Dallas	691,918	461,153	Sand and gravel, clays.
Decatur	(2)	(2)	Stone.
Delaware	404,890	382,010	Stone, sand and gravel.
Des Moines	296,826	311,820	Do.
Dickinson	40,934	(2)	Sand and gravel.
Dubuque	520,479	424,532	Stone, sand and gravel.
Emmet	156,485	118,856	Sand and gravel.
Fayette	379,950	352,935	Stone, sand and gravel.
Floyd	238,906	328,024	Stone, sand and gravel, clays.
Franklin	457,748	478,202	Sand and gravel, stone, clays.
Fremont	(2)	(2)	Stone.
Greene	(2)	317,400	Sand and gravel.
Grundy	(2)	-----------	
Guthrie	87,312	(2)	Do.
Hamilton	50,917	(2)	Stone, sand and gravel.
Hancock	(2)	241,065	Do.
Hardin	937,150	1,293,778	Do.
Harrison	(2)	446,600	Do.
Henry	(2)	(2)	Do.
Howard	121,532	149,123	Do.
Humboldt	378,031	336,690	Do.
Jackson	116,340	168,883	Do.
Jasper	321,181	(2)	Sand and gravel.
Jefferson	113,500	(2)	Stone.
Johnson	(2)	(2)	Stone, sand and gravel.
Jones	134,989	175,147	Do.
Keokuk	13,530	(2)	Stone, coal, clays.
Kossuth	150,150	(2)	Sand and gravel.
Lee	371,554	492,133	Stone, sand and gravel.
Linn	1,052,580	1,098,425	Do.
Louisa	(2)	(2)	Do.
Lucas	(2)	184,982	Coal.
Lyon	129,060	77,137	Sand and gravel.
Madison	2,042,065	2,119,133	Stone, clays.
Mahaska	824,448	1,120,063	Coal, stone, clays.
Marion	3,075,432	2,805,852	Coal, stone, sand and gravel.
Marshall	(2)	(2)	Sand and gravel.
Mills	(2)	(2)	Stone.
Mitchell	378,818	397,556	Stone, sand and gravel.
Monona	49,496	114,000	Sand and gravel.
Monroe	306,710	313,062	Coal, stone.
Montgomery	(2)	(2)	Stone.
Muscatine	870,938	1,100,311	Sand and gravel, stone.
O'Brien	6,265	209,543	Sand and gravel.
Osceola	(2)	(2)	Do.
Palo Alto	81,265	(2)	Do.
Plymouth	333,468	216,341	Sand and gravel, stone.
Pocahontas	(2)	(2)	Stone, sand and gravel.
Polk	15,509,868	14,434,737	Cement, sand and gravel, stone, clays, coal.
Pottawattamie	(2)	(2)	Stone.
Poweshiek	-----------	(2)	Do.
Sac	(2)	(2)	Sand and gravel.
Scott	11,932,732	13,163,584	Cement, stone, lime, clays, sand and gravel.
Sioux	561,471	(2)	Sand and gravel.
Story	359,192	475,742	Stone, sand and gravel, clays.

See footnotes at end of table.

TABLE 6.—Value of mineral production in Iowa by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Tama	(2)	(2)	Stone, sand and gravel.
Taylor	(2)	(2)	Stone.
Union	$932	$5,978	Sand and gravel.
Van Buren	616,264	528,591	Stone, coal, sand and gravel.
Wapello	594,130	440,767	Stone, coal, clays.
Warren	28,825	33,991	Clays, coal.
Washington	(2)	(2)	Stone.
Webster	5,092,674	6,320,862	Gypsum, stone, clays, sand and gravel.
Winnebago	34,267	(2)	Sand and gravel.
Winneshiek	364,597	76,165	Sand and gravel, stone.
Woodbury	554,996	(2)	Sand and gravel.
Worth	(2)	51,360	Do.
Wright	141,590	97,798	Do.
Undistributed	14,003,410	14,916,450	
Total [3]	85,356,000	88,557,000	

[1] The following counties are not listed because no production was reported: Davis, Ida, Iowa, Page, Ringgold, Shelby, and Wayne.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Total has been adjusted to eliminate duplicating the value of clays and stone.

Iowa Clay Products Co., Centerville, produced heavy clay products. Three limestone quarries operated near Centerville, and the output was crushed for highway and agricultural use.

Benton.—Garrison Brick & Tile Works produced heavy clay products. Some limestone and sand and gravel also were produced.

Boone.—Grarock, Inc., sold miscellaneous clay. Sand and gravel was produced by four companies and the Boone County Highway Department.

Cerro Gordo.—Mason City Brick & Tile Co. produced clay for making tile. Cement producers were Lehigh Portland Cement Co. and Northwestern State Portland Cement Co. Both companies had plants near Mason City and operated their own clay and limestone quarries. The Dewey Portland Cement Co. also sold crushed limestone on the open market. Limestone and sand and gravel, primarily for building and highway use, were mined by several companies.

Dallas.—Adel Clay Products Co. and Redfield Brick & Tile Co., both at Redfield, and United Brick & Tile Co. of Iowa, at Sioux City, produced miscellaneous clay for manufacturing heavy clay products. Building and paving sand and gravel were produced at four pits.

Des Moines.—Development of an underground gypsum mine, near Sperry, by United States Gypsum Co. neared completion. Mining operations were scheduled to begin in 1960. Three limestone quarries and a sand and gravel pit were operated in the county.

Floyd.—Rockford Brick & Tile Co. produced clay for making heavy clay products. Three sand and gravel pits and five limestone quarries were operated. Most of the material was used for building and road construction.

Franklin.—Sheffield Brick & Tile Co. produced clay for heavy clay products. Sand and gravel was produced by the Franklin County Highway Department and four commercial operators. Limestone was quarried and crushed by three companies.

Koekuk.—Nelson Coal Co. stripped bituminous coal from a seam about 78 inches thick; all coal was shipped by truck. John Nelson & Sons mined miscellaneous clay and some fire clay. Kaser Construction Co. quarried and crushed limestone for agricultural use and road construction.

Lucas.—The Big Ben Coal Co. operated an underground mine on a 72-inch seam, and the Oakdale Coal Co. operated a strip mine on a 32-inch seam.

Madison.—Marquette Cement Manufacturing Co. produced clay and limestone for manufacturing cement. Penn-Dixie Cement Corp. quarried limestone for use at its plant near Des Moines. A substantial tonnage of limestone for building and highway use was mined by private operators and the Madison County Highway Department.

Mahaska.—Eight bituminous-coal strip mines were operated during the year. One new strip mine, operated by De Long Coal Co., began production during the year. The Edwards Coal Co., which operated an underground mine in 1958, did not produce coal in 1959. The Angus Coal & Hauling Co. and Mich Coal Co. were the county's largest producers. Oskaloosa Clay Products Co. and What Cheer Clay Products Co. mined miscellaneous clay for making heavy clay products. The latter company produced some fire clay. Limestone, used primarily for road surfacing, was quarried and crushed by Mahaska County Engineer Department and Kaser Construction Co.

Marion.—Over half of the bituminous coal produced in Iowa came from mines in Marion County. There were 4 underground and 12 strip mines. The county's largest coal producer was Wilkinson Coal Co., operating a strip mine. New stripping operators in the county included E. and W. H. Groendyke, Hopkins Coal Co., and Valley Coal Co. Operators not producing in the county were Liberty Coal Co., Hustad Bros., and Klein Coal Co.; the two last-named firms operated strip mines in 1958. Three limestone quarries and four sand and gravel pits were operated in the county. Their output was used largely for building and road construction.

Monroe.—Bituminous coal was produced by six underground and three strip operators during the year. There were four strip operators in 1958; however, in 1959 no production was reported by De Long Coal Co. Coal seams ranged from 36 to 72 inches in thickness. Limestone was quarried and crushed by Kaser Construction Co., of Des Moines.

Polk.—Hopkins Coal Co. operated a strip mine on a seam about 40 inches thick. Des Moines Clay Co., John Furman Contracting Co., and United Brick and Tile Co. of Iowa produced miscellaneous clay for manufacturing heavy clay products. Marquette Cement Manufacturing Co. and Penn-Dixie Cement Co., both of Des Moines, obtained clay and limestone from pits in Madison County. Both companies produced type I and II, general-use and moderate-heat portland cement, and type III, high-early-strength portland cement. Marquette Cement Manufacturing Co. also produced masonry cement. Nearly 1 million tons of building and paving materials (sand and gravel and limestone) was produced by eight companies.

Scott.—Dewey Portland Cement Co., near Davenport, produced type I and II, general-use and moderate-heat cements, and type III, high-early-strength cement. The company produced clay and limestone from nearby sources. Lindwood Stone Products Co. produced quicklime and hydrated lime at Buffalo and was the only operation of this type in the State. Several other limestone quarries were operated in the county, and the output was used largely for concrete aggregate and road material. Building sand was produced near Princeton.

Story.—Nevada Brick & Tile Co. produced heavy clay products. Sand and gravel and limestone were mined chiefly for road construction and agricultural use.

Van Buren.—Laddsdale Coal Co. operated a strip mine on a 42-inch seam. Douds Stone, Inc., at Douds, operated an underground limestone quarry. Three surface quarries were also operated in the county; the stone was crushed and sold for agricultural use and highway construction. A sand and gravel pit near Farmington produced building and paving material.

Wapello.—Bituminous coal was produced from one underground and three strip mines during the year. The underground mine, new in 1959, was operated by Aubrey Coal Co. Changes in strip operations included a new producer, De Long Coal Co., and a nonproducer, Homer Haines Coal Co., Inc. Ottumwa Brick & Tile Co. mined miscellaneous clay for making heavy clay products. Limestone was quarried and crushed near Ottumwa.

Warren.—Hy-Line Coal Co. produced a small quantity of coal from a strip mine. No production was reported in 1958 for Warren County. Carlisle Brick & Tile Co., at Carlisle, and Goodwin Tile & Brick Co., Des Moines, produced clay for making heavy clay products.

Webster.—Crude gypsum was mined and processed in the Fort Dodge area by Bestwall Gypsum Co., Celotex Corp., National Gypsum Co., and United States Gypsum Co. Perlite was expanded at the four gypsum processing plants. Operators of three limestone quarries (one underground) and five sand and gravel operators reported production chiefly for road and construction use. Vincent Clay Products Co. produced clay for mortar mix and for manufacturing heavy clay products. Johnson Clay Works, Inc., Kalo Brick & Tile Co., and Lehigh Sewer Pipe & Tile Co. also produced heavy clay products.

The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of Kansas.

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SINCE 1861, Kansas has produced minerals valued at approximately $8.5 billion. In 1959, its mineral production was valued at $500.0 million, about $3 million less than in 1958. Mineral output was reported from 102 of the 105 counties. Five counties were credited with mineral production valued at $20 million or more each—Barton, Ellis, Russell, Butler, and Graham. The five principal minerals, in order of value, were petroleum, natural gas, cement, stone, and salt.

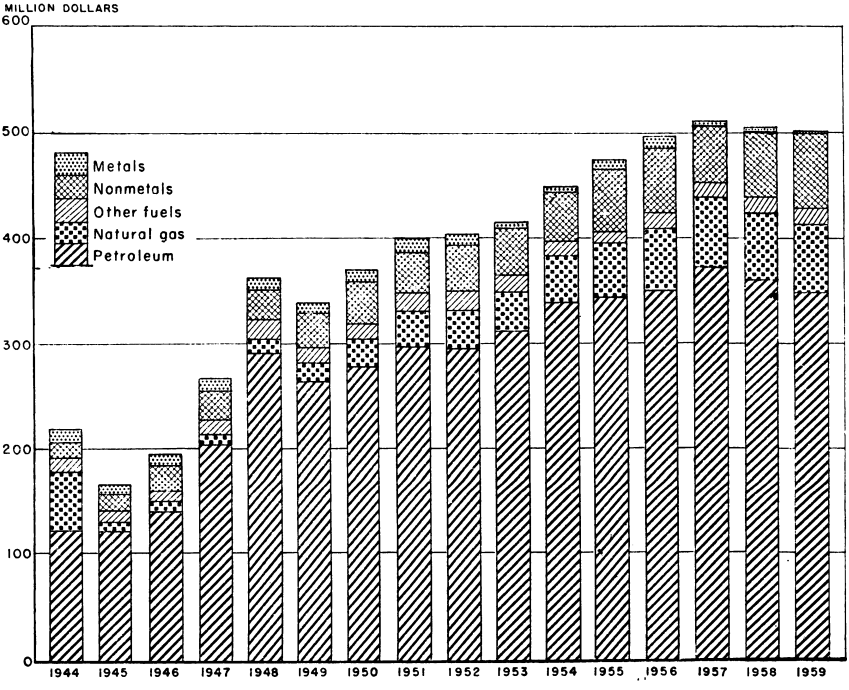

FIGURE 1.—Value of mineral production in Kansas, 1944–59.

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TABLE 1.—Mineral production in Kansas [1]

Minerals	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless (otherwise stated)	Value (thousands)
Cement [2] thousand 376-pound barrels	9,601	$30,048	10,405	$32,282
Clays	875	1,145	1,021	1,271
Coal	823	3,711	772	3,607
Helium thousand cubic feet	27,888	432	21,643	343
Lead (recoverable content of ores, etc.) short tons	1,299	304	481	111
Natural gas million cubic feet	561,816	64,047	[3] 565,000	[3] 65,000
Natural-gas liquids:				
Natural gasoline thousand gallons	110,293	6,229	107,814	5,576
LP-gases do	115,175	5,193	124,874	6,658
Petroleum (crude) thousand 42-gallon barrels	119,942	359,826	[3] 119,514	[3] 347,786
Salt (common)	1,073	11,348	1,123	13,670
Sand and gravel	10,317	6,769	11,334	7,937
Stone [4]	12,424	15,036	13,999	17,108
Zinc (recoverable content of ores, etc.) short tons	4,421	902	1,017	234
Value of items that cannot be disclosed: Natural cement, gem stones, gypsum, pumice, stone (dimension and crushed sandstone)		1,627		2,012
Total Kansas [5]		[6] 503,788		500,464

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes natural cement, value of which is included with "Value of items that cannot be disclosed."
[3] Preliminary figure.
[4] Excludes value of some stone included with "Value of items that cannot be disclosed."
[5] Total adjusted to eliminate duplication in the value of clays and stone.
[6] Revised figure.

Employment and Injuries.—According to the Employment Security Division of the Kansas Department of Labor, the average annual employment in Kansas mining industries in 1959 was 18,300, or slightly more than in 1958. Weekly earnings per person in the mining industries average $100.14, compared with $97.13 in 1958.

According to the Workmen's Compensation Commission, State of Kansas, 931 on-the-job injuries occurred in the mining industries in 1959, of which 14 were fatal; 2 fatalities occurred in coal mining, 11 in oil- and gas-well drilling, and 1 in nonmetal mining.

TABLE 2.—Average annual employment, mining industries and products of petroleum and coal [1]

Industry group	Average annual employment					
	1950–54 (average)	1955	1956	1957	1958	1959 [2]
Mining (total)	18,300	19,000	19,300	18,500	18,200	18,300
Metal mining	560	400	400	300	100	(3)
Mining and quarrying of nonmetallic metals, except fuels	1,680	1,800	2,000	1,800	1,800	1,900
Bituminous coal and lignite mining	680	400	400	400	300	300
Crude petroleum and natural gas	15,380	16,400	16,000	16,000	16,000	16,100
Petroleum refining and related industries	5,180	4,900	4,900	4,900	4,800	4,900

[1] Employment Security Division, Kansas Department of Labor.
[2] Preliminary figures.
[3] Employment estimated to be less than 100.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The mineral fuels (petroleum, natural gas, natural-gas liquids, helium, and coal) supplied almost 86 percent of the value of all minerals produced in 1959.

Carbon Black.—Production and value of carbon black increased about 20 percent. The output came from the plants of Columbian Carbon Co. at Hickok and United Carbon Co. at Ryus. Both furnace-type plants use liquid petroleum gases and natural gas as feed.

TABLE 3.—Carbon black production

[Kansas Corporation Commission]

	1956	1957	1958	1959
Carbon black produced, all grades....pounds..	105,680,834	76,419,500	75,443,750	91,644,160
Value at plants....................................	$6,590,662	$5,131,569	$5,271,143	$6,387,598
Natural gas processed....thousand cubic feet..	8,286,680	5,667,958	3,262,970	4,624,404
LP-gases and other liquid fuel processed barrels..	352,594	347,975	2,251,023	390,063

Coal.—Bituminous coal was produced in Bourbon, Cherokee, Coffey, Crawford, and Osage Counties; more than 1,000 tons was reported from 13 mines. Two underground mines in two counties supplied 1 percent of the State's tonnage and value. All underground production was cut by machines, and 52 percent was power drilled. Strip-mine production reported from 11 mines in 5 counties supplied 99 percent of the tonnage and value. Overburden excavated totaled nearly 16 million cubic yards—almost 5 cubic yards for each ton of strip-mined coal. At four mines about 91 percent of the coal was mechanically cleaned, and at four mines over 65 percent was crushed; at two mines 4 percent of the coal was oil treated. Nearly 87 percent of the coal output was shipped by rail and 13 percent by truck.

TABLE 4.—Production of coal at mines producing more than 1,000 tons

Year	Number of mines			Short tons (thousands)	Value (thousands)
	Underground	Strip	Total		
1950–54 (average)................	----------	----------	----------	1,840	$7,315
1955..................................	5	19	24	742	3,166
1956..................................	4	15	19	884	3,856
1957..................................	3	14	17	749	3,331
1958..................................	2	13	15	823	3,711
1959..................................	2	11	13	772	3,607

Helium.—The Federal Bureau of Mines at its Otis helium plant in Rush County, extracted 24 million cubic feet of helium gas from natural gas from the Otis-Albert, Ryan, Pawnee Rock, Berhens, Unruh, Reichel, and Shaffer fields—about 7 percent less than in 1958. Shipments totaled 21.6 million cubic feet valued at $343,000. Legislation pending in Congress would provide for the construction of several helium plants in the midcontinent area to remove helium from natural gas going to market and for the purchase of the extracted helium by the Government for storage underground and future use. The quantity and helium content of gas produced from other Kansas fields is sufficient for economic extraction under this program.

Natural Gas.—Although the quantity and value of natural gas produced and marketed in Kansas set a new record in 1959, the State dropped to sixth place in natural gas production. The estimated reserve of proved recoverable gas decreased slightly to 19,981 billion cubic feet. The vast Hugoton field, covering all or part of 9 counties, accounted for about 70 percent of the State's gas production; the remainder came from fields in 41 other counties. Barber County, which accounted for 9 percent of the State's output, was the next most prolific gas area.

TABLE 5.—Marketed production of natural gas

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1950-54 (average)	405,416	$34,394	1957	586,690	$66,883
1955	471,041	52,286	1958	561,816	64,047
1956	526,091	59,448	1959[1]	565,000	65,000

[1] Preliminary figures.

TABLE 6.—Gas production in 1959 from prorated fields

[Conservation Division, Kansas Corporation Commission]

Field	County	Number of wells	Production, million cubic feet
Aetna	Barber	6	410
Bartholow	do	2	95
Blunk	do	4	615
Boggs	do	12	3,533
Driftwood	do	30	4,183
Elsea	do	4	653
Elwood	do	8	1,577
Goetz	Kingman	2	145
Greenwood	Morton	243	53,278
Hardtner	Barber	46	8,438
Hugoton	SW. Kansas	3,901	404,764
McGuire-Goemann	Barber	12	1,610
McKinney	Meade Clark	58	6,760
Medicine Lodge, SW	Barber	2	128
Medicine Lodge, W	do	30	4,334
Nichols	Kiowa	8	1,981
Rhodes, N	Barber	15	4,939
Rhodes, NE	do	15	2,529
Rhodes, S	do	11	1,618
Richfield	Morton	9	4,373
Sharon, NW	Barber	19	3,142
Sparks	Stanton	20	6,190
Spivey Grabs	Kingman Harper	164	12,621
Taloga "C"	Morton	2	119
Taloga "G"	do	1	114
Taloga Keys	do	5	1,287
Wil	Edwards	2	133

TABLE 7.—Underground gas storage

Company and field	County	Zone	Capacity, million cubic feet		
			Working gas	Cushion gas	Total
Cities Service Gas Co.:[1]					
Boyer	Butler	Wabaunsee	392	628	1,020
Colony	Anderson	Colony	4,148	5,056	9,204
Craig	Johnson	Bush City	1,558	4,518	6,076
Elk City	Elk [2]	Burgess	4,500	15,500	20,000
McLouth	Jefferson and Leavenworth	Bartlesville	5,212	7,702	12,914
Piqua	Allen and Woodson	Colony	1,551	1,679	3,230
Welda North	Anderson	do	4,522	5,500	10,022
Welda South	do	do	5,314	6,475	11,789
Consolidated Gas Utilities Corp.:					
Collinson	Cowley		647	426	1,073
Union Gas System, Inc.:					
Buffalo	Wilson	Iola	4,119	4,131	8,250
Fredonia	do	Layton			
Liberty South	Montgomery	Squirrel			
Liberty North	do	do			
Longton	Chautauqua	Layton			
Total			31,963	51,615	83,578

[1] Use of Sutcliff field for gas storage was discontinued in 1959.

[2] Originally produced gas by water displacement. The value given for cushion-gas capacity represents present cushion-gas capacity plus additional capacity from which water has not yet been displaced.

Important new gasfields discovered during the year and the initial production of the discovery well, according to the Kansas Geological Survey, were:

County	*Pool or field*	*Initial production (thousand cubic feet per day)*
Barber	ILS Southwest	10,000
Clark	Sitka	11,000
Grant	Hattie	14,000
Do	Panoma Northeast	6,940
Do	Ulysses	2,184
Kearny	Hattie Northeast	7,000
Meade	Barragree	13,434
Do	Borchers	100,000
Do	Borchers Northwest	10,842
Do	Horace South	42,231
Morton	Kinsler	19,000
Do	Wilburton	17,900
Stafford	Haynes Southwest	16,000
Stanton	Beauchamp East	11,500
Stevens	Perrill	26,000

Natural-Gas Liquids.—Production of natural-gas liquids (233 million gallons) increased 3 percent in quantity and 7 percent in value. Of the total recovered, 54 percent was LP-gases and the remainder natural gasoline. Fourteen natural-gasoline plants were active—two less than in 1958. Proved recoverable reserve of natural-gas liquids was estimated by the American Gas Association at 8,270 million gallons, or 111 million gallons less than in 1958.

Petroleum.—Kansas, with 80 counties reporting activity, ranked sixth in the Nation in production of petroleum. The western part of the State was the most productive area. The five leading petroleum-producing counties were Barton, Ellis, Russell, Butler, and Graham.

TABLE 8.—Natural-gas liquids produced

(Thousand gallons and thousand dollars)

Year	Natural gasoline		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	112, 753	$6, 506	73, 004	$2, 535	185, 757	$9, 041
1955	118, 599	6, 318	92, 596	2, 643	211, 195	8, 961
1956	105, 482	5, 928	90, 287	3, 843	195, 769	9, 771
1957	119, 247	6, 569	103, 494	4, 042	222, 741	10, 611
1958	110, 293	6, 229	115, 175	5, 193	225. 468	11, 422
1959	107, 814	5, 576	124, 874	6, 658	232, 688	12, 234

TABLE 9.—Natural gasoline and LP-gases produced in 1959, in barrels

[Conservation Division, Kansas Corporation Commission]

Company	Location		Natural gasoline	Butane	Propane	LP-gases	Total
	Nearest town	County					
Cities Service Oil Co	Burrton	Reno	40, 000	---------	22, 000	38, 000	100, 000
Do	Wichita	Sedgwick	406, 000	375, 000	306, 000	---------	1, 087, 000
Colorado Interstate Gas Co	Lakin	Kearny	78, 865	---------	---------	---------	78, 865
Dunn-Mar Oil & Gas Co	Otis	Rush	19, 010	1, 952	---------	---------	20, 962
Hugoton Production Co	Ulysses	Grant	152, 511	168, 849	174, 974	---------	496, 334
Kansas-Nebraska Natural Gas Co.	Deerfield	Kearny	132, 281	---------	13, 932	10, 275	156, 488
Northern Natural Gas Co	Holcomb	Finney	79, 581	---------	---------	---------	79, 581
Do	Sublette	Haskell	168, 138	---------	---------	---------	168, 138
Pan American Petroleum Corp.	Ulysses	Grant	474, 862	599, 508	427, 211	---------	1, 501, 581
Panhandle Eastern Pipeline Co.	Liberal	Seward	505, 408	222, 027	126, 039	---------	853, 474
Plateau Natural Gas Co	Cheney	Sedgwick	15, 325	---------	---------	7, 573	22, 898
Skelly Oil Co	Medicine Lodge.	Barber	111, 279	---------	89, 201	---------	200, 480
Socony Mobil Oil Co., Inc	Ulysses	Grant	185, 693	47, 585	91, 939	---------	325, 217
Do	Spivey	Kingman	185, 412	92, 254	175, 299	---------	452, 965

As Kansas fields grow older, secondary-recovery production methods are accounting for an increasing proportion of the State's oil production. In 1959, only 20 years after waterflooding was legalized in the State, 15 percent of the State's production was recovered by secondary methods.[4] A report by the Federal Bureau of Mines [5] described waterflooding methods that were applied with outstanding success in Greenwood County.

TABLE 10. Production of crude petroleum

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950-54 (average)	114, 160	$301, 638	1957	123, 614	$372, 078
1955	121, 669	340, 670	1958	119, 942	359, 826
1956	124, 204	346, 529	1959 [1]	119, 514	347, 786

[1] Preliminary figures.

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[4] Miller, Glenn H. Jr., Mineral and Water Resources, Economic Development in South Central Kansas, Part IV: Center for Research in Business, University of Kansas, June 1959, 142 pp.

[5] Johnson, Kenneth, H., Four Waterflooding Projects in Greenwood County, Kans., 1960: Bureau of Mines Inf. Circ. 7969, 1960, 36 pp.

TABLE 11.—Production, indicated demand, and stocks of crude petroleum by months, 1959, thousand barrels

Month	Production	Indicated demand	Stocks originating in Kansas (end of month)
January	10,415	11,186	9,266
February	9,223	9,587	8,902
March	10,530	10,993	8,439
April	10,302	8,776	9,965
May	9,906	9,235	10,636
June	9,842	10,360	10,118
July	9,896	9,506	10,508
August	9,575	9,892	10,191
September	9,779	10,956	9,014
October	10,094	9,440	9,668
November	9,740	9,780	9,628
December	10,212	10,112	9,728
Total: 1959[1]	119,514	119,823	------------
1958	119,942	120,057	------------

[1] Preliminary figures.

TABLE 12.—Pipeline runs of crude petroleum by fields, thousand barrels

[Kansas Geological Survey]

Field	1955	1956	1957	1958	1959
Bemis-Shutts	3,232	3,055	5,922	5,063	4,868
Bloomer	1,207	1,024	954	789	723
Browning	118	400	1,126	1,031	768
Burnett[1]	2,008	2,074	------------	------------	------------
Chase-Silica	3,282	3,482	4,271	3,260	3,689
Cooper	851	1,513	1,416	1,317	1,109
El Dorado	4,232	4,359	4,619	4,371	4,443
Fairport	901	980	1,061	1,065	1,040
Garfield	916	1,836	1,742	1,092	649
Geneseo-Edwards	2,934	2,784	2,236	1,812	1,680
Gladys	1,014	1,810	1,859	1,638	1,202
Gorham	1,571	1,515	1,501	1,499	1,421
Hall-Gurney	4,076	3,598	3,543	3,296	3,253
Iuka-Carmi	1,450	1,472	1,219	1,035	855
Kraft-Prusa	4,096	3,712	3,437	3,092	2,890
Marcotte	1,711	1,887	2,020	1,779	1,596
Morel	1,472	1,482	1,617	1,477	1,354
Ray	1,311	1,225	1,314	1,353	1,363
Rhodes	1,020	947	1,074	664	403
Ritz-Canton	1,985	1,470	1,563	1,542	1,321
Seeley-Wick	1,489	1,307	978	719	583
Silica South[2]	1,043	1,003	------------	------------	------------
Spivey-Grabs[3]	1,139	1,758	2,031	1,961	2,370
Trapp	4,797	4,241	3,728	3,366	3,120
Trico[4]	------------	935	1,239	1,253	1,117
Unger	20	147	1,126	1,189	1,008
Welch-Bornholdt	1,238	1,106	1,240	1,216	932
Other fields	72,048	73,345	71,218	73,063	75,717
Total	121,161	124,467	124,054	119,942	119,474
Change in field stocks[5]	------------	------------	------------	------------	+40
Total productions[5]	121,669	124,204	123,614	119,942	119,514

[1] Combined with Bemis-Shutts in 1957.
[2] Combined with Chase-Silica in 1957.
[3] Formed by combination of Spivey and Grabs fields in 1956.
[4] Formed in 1956 by combination of Allphin, Allphin Northwest, Annon, Annon South, Basset, Laura Southeast, Marcotte South, Noah, Spaulding, and White Southwest fields.
[5] Bureau of Mines data.

Drilling and Exploration.—Exploratory and development drilling (excluding eastern Kansas) totaled 14.2 million feet, a slight gain over 1958. However, the number of exploratory and development wells drilled[6] (excluding eastern Kansas) and the proved oil reserve[7] of the State decreased for the fourth consecutive year. For many years drilling in the eastern Kansas "stripper" area had not been scouted; consequently, records of wells drilled in that area were incomplete and inaccurate. The Kansas Geological Survey's estimate of drilling in east Kansas counties, based on a survey of secondary-recovery operations and intent-to-drill permits issued by the State Corporation Commission, showed 1,008 wells in this category ("unclassified" column, table 13); most of these were on waterflooding projects. Thus, all types of wells drilled in the State totaled 5,786 in 1959. The International Oil Scouts Association[8] reported 3,369 exploratory and development wells drilled in 1959, exclusive of eastern Kansas, compared with 3,750 drilled in 1958. Of these, 1,264 were exploratory wells; 234 produced oil, 47 produced gas, and 983 were dry. Of 2,105 proved field or development wells drilled, 1,275 produced oil, 139 produced gas, and 691 were dry.

TABLE 13.—Wells drilled and crew-weeks spent in geophysical oil and gas prospecting in 1959

County	Wells drilled [1]							Geophysical prospecting [2] (crew-weeks)		
	Oil	Gas	Oil and Gas	Service	Dry	Unclassified [3]	Total	Seismograph	Gravity meter	Magnetometer
Allen	74			4		314	392			
Anderson	18			5		33	56			
Barber	16	26	3		37		82	0.50		
Barton	118	1		5	108		232			
Bourbon	3			2		11	16			
Brown										4.25
Butler	171			72	108		351	7.00		2.00
Chase	7				19		26			
Chautauqua	23			5	2	74	104			
Cheyenne	5				15		20	24.50		
Clark		9			4		13	22.00		
Clay					5		5		1.25	
Cloud					1		1		1.00	
Coffey				5	1		6			
Comanche	1				6		7	28.50		
Cowley	106	1	3	7	118		235	2.00		
Crawford	36			54		66	156			
Decatur	5				19		24	2.00		
Dickinson	2				7		9			
Douglas	8				1	40	49			
Edwards	53	11	5		37		106			
Elk	12				10	22	44			
Ellis	110			2	136		248	3.50		
Ellsworth	4				21		25			
Finney	30	27			16		73	11.50	1.00	
Ford		1			4		5	4.00		
Franklin	22			56		99	177			
Geary	1				8		9	1.00		.50
Gove					3		3	5.50		
Graham	85			1	103		189	9.75		
Grant	2	5			5		12	9.00		7.75
Gray								10.00		
Greeley					1		1	6.00		
Greenwood	166			29	72		267			

See footnotes at end of table.

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[6] Oil and Gas Journal, vol. 58, Jan. 25, 1960.

[7] American Petroleum Institute and American Gas Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vols. 11–14, 1959.

[8] International Oil Scouts Association, International Oil and Gas Development, vol. 30, 1959.

TABLE 13—Wells drilled and crew-weeks spent in geophysical oil and gas prospecting in 1959—Continued

County	Wells drilled [1]							Geophysical prospecting [2] (crew-weeks)		
	Oil	Gas	Oil and Gas	Service	Dry	Unclassified [3]	Total	Seismograph	Gravity meter	Magnetometer
Hamilton		1			5		6			1.50
Harper	27	2	17	1	22		69	10.50		
Harvey	12		1	1	29		43	26.00		
Haskell	16	3	1		10		30	0.75	1.00	
Hodgeman	12				16		28	16.25		
Jackson					2		2			6.25
Johnson	3	2			12	11	28			
Kearney	1	4			3		8	5.00	.75	
Kingman	52	13	18	1	47		131	21.50		
Kiowa	14	1			18		33			
Labette	7			3	10	15	35			
Lane					2		2	8.00		
Lincoln					1		1	9.00		
Linn	1			2		11	14			
Logan	1				3		4	11.25		
Lyon				2	11		13			2.50
Marion	187	3		10	69		269			
Marshall					3		3		11.75	
McPherson	65		1	1	61		128	2.00		
Meade	7	33	5		28		73	2.00		
Miami	10			14		36	60			
Mitchell								2.50		
Montgomery	13			19		56	88			
Morris	5	8			20		33			.75
Morton	1	8	1		2		12	31.00		
Nemaha	1				1		2		.50	3.75
Neosho	48			25		89	162			
Ness	14			1	17		32	3.75		
Norton	8				28		36			
Osborne	2				7		9			
Pawnee	2	1	1		26		30	1.00		
Phillips	14				2		16			
Pottawatomie					15		15		1.50	7.00
Pratt	17	3	1		30		51	5.00		
Rawlins	33				27		60	41.50		
Reno	29	7			38		74	8.00		
Republic									2.00	.50
Rice	36				35		71	2.00		
Riley	23				11		34		1.50	.50
Rooks	55			4	53		112			
Rush	5	3			15		23	1.75		
Russell	77			6	54		137			
Saline	20				15		35			
Scott	1				3		4	.75		
Sedgwick	37			3	53		93	5.00		
Seward	3	4			9		16	1.75	.50	
Shawnee										.75
Sheridan	6				37		43	4.75		
Sherman	5				7		12	13.75		
Stafford	81	3		2	90		176	4.75		
Stanton	2	1			8		11	2.25		4.50
Stevens		12			10		22	11.00	5.00	
Sumner	56			3	91		150	13.50		
Thomas	1				9		10	5.25		
Trego	10				35		45	3.50		
Wabaunsee	5				18		23	2.00		9.25
Wallace					3		3	57.75		
Washington					5		5	18.75	11.75	.50
Wichita					1		1	3.00		
Wilson	30			19		77	126			
Woodson	28	1		8		54	91			
Total: 1959	2,161	194	57	372	1,994	1,008	5,786	503.25	39.50	52.25
1958	1,685	231			1,834		[4] 3,750	416.00	52.00	22.00

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[1] State Geological Survey of Kansas, Oil and Gas Developments in Kansas in 1959, Bull. 147.

[2] International Oil Scouts Association, International Oil and Gas Development: Vol. 30, 1959, excludes southeastern Kansas.

[3] Estimated.

[4] International Oil Scouts Association, International Oil and Gas Development: Vol. 30, 1959. Does not include service wells or drilling in eastern Kansas.

TABLE 14.—Important new oilfields discovered in 1959

[Kansas Geological Survey]

Field	County	Initial production (barrels a day)	Field	County	Initial production (barrels a day)
Hammeke West	Barton	455	Wilhelm	Rawlins	258
Redwing Southwest	do	360	Yaege	Riley	36
Shannon	Cowley	334	Chesney	Rooks	435
Wampler	Finney	855	Beauchamp	Stanton	456
Lindenman	Graham	340	Conway Springs	Sumner	1,683
Nova	Hodgeman	3,000	Lanisia	Thomas	211
Cahoj	Rawlins	3,000	Wilmington	Wabaunsee	88

Pipelines.—No major pipelines were constructed in Kansas in 1959. Michigan Wisconsin Pipe Line Co. completed loops on its main line that extended from the Hugoton area diagonally eastward across the State. Construction of four 24-inch loops and part of a fifth totaled 137 miles of line. Cities Service Gas Co. installed the following loops in its system: 21 miles of 30-inch pipe running from Welda, 10 miles of 16-inch pipe from Ottawa, 7 miles of 16-inch pipe from Ft. Scott, and 15 miles of 12-inch pipe between Lyons and Ellsworth. At Lawrence 4.5 miles of 16-inch pipe was replaced, and at Hutchinson 10 miles of 8-inch pipe was replaced with 12-inch pipe. Wheatland Natural Gas Co. installed two small gas-distribution systems in western Kansas to supply fuel for irrigation systems. One system, in Scott, Wichita, and Wallace Counties, comprised about 125 miles of line ranging from 1 to 4 inches in size; the other, in Finney, Gray, and Haskell Counties, consisted of about 65 miles of 1- and 2-inch pipe.

Cities Service Gas Co. announced plans to build, in 1960, two 3,600-hp. compressor stations at a cost of $2.4 million on the company's 26-inch pipeline that extends from the Hugoton field to Kansas City. Plans were announced by Missouri-Kansas-Texas Railroad to build a 1,500-mile products pipeline, at a cost of $55 million, from West Texas across Kansas to points in the Midwest. A 12-inch pipeline was to carry butane, propane, and natural gasoline to McPherson, Kans.; from that point, one branch would run to Minneapolis and St. Paul, Minn., and another to Madison, Wis.

Refineries.—At the end of 1959 Kansas had 13 active refineries and 1 idle one with a total refining capacity of 121,043,000 barrels of crude oil a year, according to the Oil and Gas Journal. Runs of crude oil to the stills of these refineries totaled 109,104,000 barrels—equivalent to 91 percent of the year's production and 90 percent of the total refining capacity.

NONMETALS

Barite.—Barium monohydrate and barium carbonate were produced at Coffeyville by Sherwin-Williams Co.

Boron.—The Callery Chemical Co. plant at Lawrence, a producer of boron products, was closed.

Cement.—Portland, natural, and masonry cements were manufactured in Kansas. Portland cement plants in Allen, Neosho, Montgomery, Wilson, and Wyandotte Counties produced 10.1 million

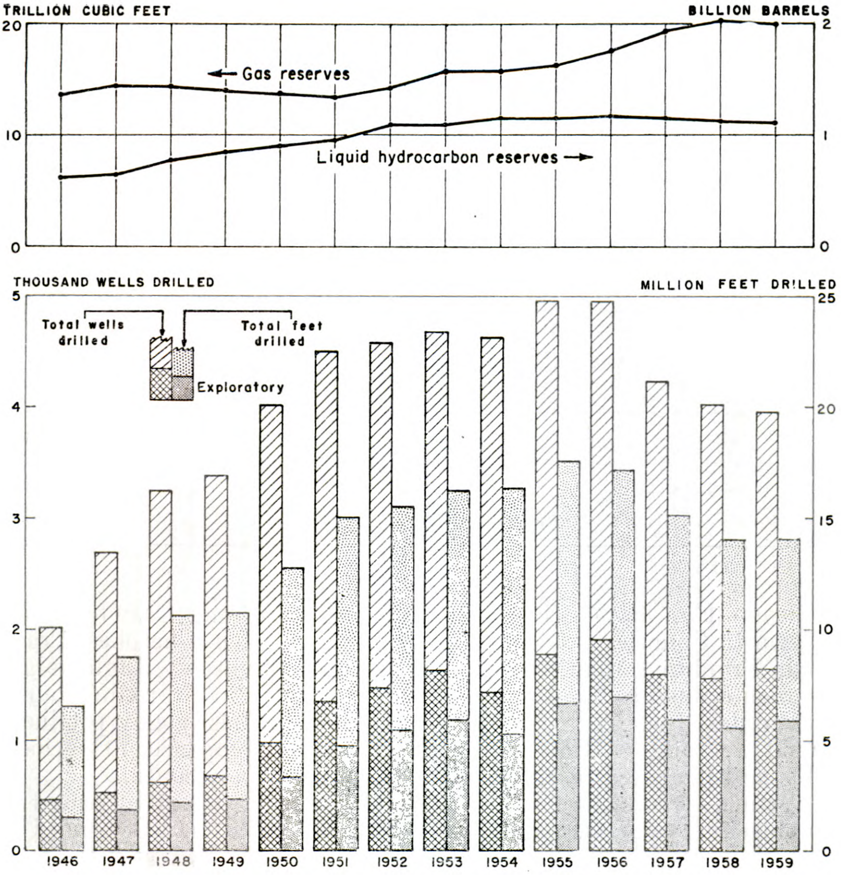

FIGURE 2.—Proved reserves and drilling in Kansas, 1946–59.

barrels, an average of 83 percent of capacity. About 63 percent was produced by wet-process and 37 percent by dry-process methods. Of the 10.1 million barrels, 77 percent was shipped in bulk and 23 percent in bags; about 99 percent was transported by railroad. Natural cement was produced by Fort Scott Hydraulic Cement Co. in Bourbon County. All cement plants also produced masonry cement.

TABLE 15.—Production and shipments of portland cement

Year	Production (barrels)	Shipments	
		Barrels (thousands)	Value (thousands)
1950–54 (average)	8,674,595	8,671	$21,015
1955	9,219,533	9,072	24,521
1956	10,486,150	10,240	29,371
1957	8,117,799	7,864	23,593
1958	9,244,184	9,298	28,843
1959	10,177,183	10,056	30,889

TABLE 16.—Shipments of all types of finished portland and high-early-strength cement to Kansas from mills

Year	To Kansas (thousand barrels)	Change, percent	
		In Kansas	In United States
1950-54 (average)	5,503		
1955	7,248	+10	+6
1956	6,963	−4	+6
1957	4,981	−28	−6
1958	6,397	+28	+6
1959	6,889	+8	+9

TABLE 17.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950-54 (average)	712	$757	1957	909	$1,240
1955 [1]	768	873	1958	875	1,145
1956	977	1,169	1959	1,021	1,271

[1] Excludes fire clay.

Clays.—Fire clay was produced in Barton, Cloud, Crawford, and Ellsworth Counties and miscellaneous clay in Allen, Cherokee, Crawford, Franklin, Montgomery, and Wilson Counties. Lightweight aggregate was produced from miscellaneous clay in Franklin County by Buildex, Inc. All other clays were used for heavy clay products. Cloud Ceramics at Concordia, Cloud County, reopened 10 periodic kilns and increased brick output to 3.5 million per month.

Gypsum.—Production of crude and calcined gypsum increased in tonnage and value. Gypsum was produced by National Gypsum Co., near Medicine Lodge, Barber County, and by Bestwall Gypsum Co., at Blue Rapids, Marshall County. Bestwall Gypsum Co. began constructing a $4 million plant at Blue Rapids to replace its present facilities which were to be inundated by the lake created by Tuttle Creek Dam. The company was reimbursed $1 million by the U.S. Army Corps of Engineers, builders of the dam, for land and facilities. The new plant and replacement facilities, scheduled for completion by July 1960, were to include an additional unit for producing gypsum board and lath and would necessitate a 100-percent increase in mine production of gypsum.

Lime.—Mid-Continent Quarries Lime Co. was constructing the State's first lime plant at the Lorring Quarries, 4 miles west of Bonner Springs in Leavenworth County. Expected markets for the 150-ton-per-day plant were Kansas City, Topeka, Wichita, and surrounding areas. Consumption was to be mainly for municipal water and sewage treatments. About 15 workers were to be employed.

Nitrogen Compounds.—Cooperative Farm Chemicals Association completed new facilities to increase ammonia production from 200 to 310 tons per day and to increase urea output by 35 tons of 100-percent urea a day. The expanded urea facility and a new nitric acid plant with a capacity of 120 tons daily provided 100 tons daily of urea nitrate solutions. Further expansion of urea facilities and an additional 100-ton-per-day ammonia plant were planned for 1960.

Perlite.—Perlite was expanded by Panacalite Perlite Co. at its Kansas City plant from crude rock mined in the Western States for use mainly as lightweight aggregate. Both quantity and value decreased.

Pumice.—Crude pumice, produced near Wilson in Lincoln County and near Calvert in Norton County, was crushed for use in abrasives and cleaning powders. The output and value decreased.

Salt.—Evaporated and rock salt were produced by five companies in Ellsworth, Reno, and Rice Counties. Brine was produced in Sedgwick County by Frontier Chemical Co., a division of Vulcan Materials for manufacturing industrial inorganic chemicals. Meatpackers, livestock raisers, and leather tanners were large consumers of salt.

TABLE 18.—Salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	358	$4,852	530	$2,080	888	$6,932
1955	362	5,820	549	2,613	911	8,432
1956	461	6,352	543	2,815	1,004	9,167
1957	522	7,785	496	2,568	1,018	10,353
1958	373	7,962	[1] 700	[1] 3,386	1,073	11,348
1959	389	9,035	[1] 734	[1] 4,636	1,123	13,671

[1] Brine included with rock salt; previously included with evaporated salt to avoid disclosing individual company confidential data.

Sand and Gravel.—Sand and gravel was produced in 71 counties at 110 commercial operations and 46 Government-and-contractor operations. Approximately 88 percent of the production was used for building and highway construction. Commercial production furnished 82 percent of the tonnage and 84 percent of the value; the remainder was Government-and-contractor output. About 93 percent of the output was shipped by truck and 7 percent by railroad. Sand for blasting, grinding and polishing, engines, filtration, and other uses also was produced.

Stone.—Crushed and dimension limestone, crushed and dimension sandstone, and crushed miscellaneous stone (chats) were produced. Greatest activity was in Wyandotte, Dickinson, Johnson, Allen, Wilson, and Neosho Counties; this area accounted for nearly 41 percent of the value of stone produced, including limestone for cement. Crushed limestone was produced in 45 counties and dimension limestone in 7 counties. Crushed sandstone was obtained in Lincoln County and dimension sandstone in Bourbon County. Miscellaneous stone (chats) was produced by six operators in Cherokee County.

Vermiculite.—Vermiculite was exfoliated at Wichita, Sedgwick County, from crude material shipped from the Western States. Production was greater than in 1958. Exfoliated vermiculite was used for heat insulation and as aggregate in plaster.

TABLE 19.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	6, 595	$4, 694	2, 403	$1, 189	8, 998	$5, 883
1955	9, 000	6, 342	1, 665	568	10, 665	6, 910
1956	10, 656	7, 429	1, 859	593	12, 515	8, 022
1957	7, 680	5, 425	1, 665	750	9, 345	6, 175
1958	8, 282	5, 806	2, 035	963	10, 317	6, 769
1959	9, 257	6, 661	2, 077	1, 276	11, 334	7, 937

TABLE 20.—Stone sold or used by producers

(Thousand short tons and thousand dollars)

Year	Limestone [1]		Sandstone		Miscellaneous stone		Total stone [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1955	10, 860	$14, 341	746	$1, 243	877	$363	12, 483	$15, 947
1956	11, 654	14, 630	315	516	1, 465	557	13, 434	15, 703
1957	8, 871	11, 278	(2)	(2)	1, 540	648	[3] 10, 412	[3] 11, 926
1958	11, 495	14, 653	(2)	(2)	929	383	[3] 12, 424	[3] 15, 036
1959	13, 367	16, 883	(2)	(2)	632	225	[3] 13, 999	[3] 17, 108

[1] Includes diatomaceous marl and limestone for cement.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Excludes sandstone.

METALS

The Kansas lead- and zinc-producing area is part of the Tri-State district, which also includes northeastern Oklahoma and southwestern Missouri. Further details on Tri-State activity are given in the Oklahoma chapter.

Mills and Smelters.—Eagle-Picher Co. produced pigments and sulfuric acid at its lead smelter near Galena. Ozark Smelting & Mining Co. produced lead pigments at Coffeyville. National Lead Co. dismantled its Ballard No. 8 mill and moved it to southeastern Missouri.

Lead.—Mine production of recoverable lead decreased 63 percent to less than 500 tons. The Bird Dog mine of Eagle-Picher Co. was the largest producer; next in order were the Lindsey mine operated by Ora Black and the Robinson mine of Rea Lead & Zinc Co. Eagle-Picher Co. acquired the mining equipment, facilities, and most of the leases of the National Lead Co. in the Baxter Springs area. The transaction closed out National Lead's holdings in the district.

Uranium.—Spencer Chemical Co. expanded its Jayhawk Works near Pittsburg by completing a 100-ton-per-year plant for producing uranium dioxide. The material, converted from various uranium-containing feedstocks, was sold for conversion into fuel elements used in commercial atomic power reactors.

Zinc.—Zinc output dropped 77 percent to about 1,000 tons. Leading producers were Eagle-Picher Co., Rea Lead & Zinc Co., and Ora Black.

TABLE 21.—Mine production of lead and zinc, in terms of concentrate and recoverable metals[1]

Year	Mines producing	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content[2]			
						Lead		Zinc	
		Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	--------	8,335	$1,516	43,700	$4,324	6,346	$1,909	23,237	$6,879
1955	36	7,362	1,353	51,252	3,981	5,498	1,638	27,611	6,792
1956	41	10,130	1,955	53,142	4,688	7,635	2,397	28,665	7,854
1957	43	5,703	1,026	29,189	2,311	4,257	1,218	15,859	3,679
1958	25	1,828	242	8,210	499	1,299	304	4,421	902
1959	11	702	93	1,971	149	481	111	1,017	234

[1] Based on Kansas ore and old tailing treated at mills during calendar year indicated.

[2] In calculating metal content of the ores from assays, allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate ("ore") and metal, it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of lead and zinc is calculated from the average price for all grades.

REVIEW BY COUNTIES[9]

Mineral production was reported in 102 of the State's 105 counties in 1959; no mineral output was reported in Greely, Lane, and Ottawa Counties. Fifty-eight counties reported mineral production valued at $1 million or more each, and the five principal producing counties—Barton, Ellis, Russell, Butler, and Graham—contributed 27 percent of the value of all minerals produced.

TABLE 22.—Value of mineral production in Kansas, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Allen	$12,128,664	$12,712,865	Cement, petroleum, stone, clays, natural gas.
Anderson	(2)	1,401,634	Petroleum, stone, sand and gravel.
Atchison	428,196	330,563	Stone.
Barber	(2)	[3] 10,911,291	Natural gas, petroleum, gypsum, natural-gas liquids, sand and gravel.
Barton	35,552,787	34,102,276	Petroleum, sand and gravel, clays, natural gas.
Bourbon	904,391	748,696	Stone, cement, petroleum, coal, natural gas.
Brown	2,000	479	Sand and gravel.
Butler	23,026,857	23,340,822	Petroleum, stone.
Chase	309,069	360,495	Petroleum, stone, sand and gravel, natural gas.
Chautauqua	3,087,518	2,798,032	Petroleum, stone, natural gas, sand and gravel.
Cherokee	3,909,036	2,844,537	Coal, stone, zinc, lead, clays, sand and gravel, natural gas.
Cheyenne	53,238	58,223	Petroleum, sand and gravel.
Clark	1,478,229	1,344,683	Natural gas, petroleum, sand and gravel.
Clay	193,292	157,379	Sand and gravel, petroleum, stone.
Cloud	366,805	285,564	Clays, sand and gravel.
Coffey	452,945	356,483	Petroleum, stone, coal, sand and gravel, natural gas.
Comanche	83,852	87,999	Petroleum, sand and gravel, natural gas.
Cowley	13,715,987	12,181,480	Petroleum, stone, sand and gravel, natural gas.
Crawford	1,677,384	[3] 1,426,867	Coal, clays, petroleum, stone, natural gas.
Decatur	1,243,391	1,088,491	Petroleum, sand and gravel.
Dickinson	802,735	1,328,813	Stone, petroleum, sand and gravel.
Doniphan	414,958	342,222	Stone.
Douglas	(2)	[3] 71,938	Petroleum, sand and gravel, stone.
Edwards	950,951	2,177,994	Petroleum, natural gas, sand and gravel.
Elk	1,898,746	[3] 767,584	Stone, petroleum, natural gas, sand and gravel.
Ellis	34,676,259	32,728,719	Petroleum, stone, sand and gravel.
Ellsworth	7,444,133	7,326,833	Petroleum, salt, clays, sand and gravel.
Finney	5,319,644	[3] 8,380,903	Natural gas, petroleum, natural-gas liquids, sand and gravel.

See footnotes at end of table.

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[9] For more detailed fuels data see: Goebel, E. D., Hilpman, P. L., Beene, D. L., and Noever, R. J., Oil and Gas Developments in Kansas During 1959: Survey of Kansas Pub. Bull. 147, 1960, pp. 1–241.

TABLE 22.—Value of mineral production in Kansas, by counties [1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Ford	$286,286	$133,056	Sand and gravel, natural gas, petroleum.
Franklin	1,076,879	1,022,476	Petroleum, clays, stone.
Geary	435,574	642,357	Stone, sand and gravel.
Gove	86,244	48,687	Petroleum, sand and gravel.
Graham	20,686,571	[3] 20,053,805	Do.
Grant	12,696,151	15,067,634	Natural gas, natural-gas liquids, petroleum.
Gray	(2)	(2)	Sand and gravel.
Greenwood	18,980,195	17,393,812	Petroleum, stone, sand and gravel.
Hamilton	464,275	559,210	Natural gas, sand and gravel, petroleum.
Harper	(2)	[3] 3,983,077	Petroleum, natural gas, sand and gravel.
Harvey	(2)	1,150,358	Petroleum, natural gas.
Haskell	3,857,852	[3] 5,771,713	Natural gas, petroleum, natural-gas liquids, sand and gravel.
Hodgeman	808,451	874,433	Petroleum.
Jackson	139,918	98,747	Stone, sand and gravel.
Jefferson	493,587	486,750	Stone.
Jewell	(2)	(2)	Do.
Johnson	326,338	1,010,866	Stone, natural gas, petroleum.
Kearny	7,393,783	[3] 8,330,071	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Kingman	(2)	[3] 11,301,914	Petroleum, natural gas, natural-gas liquids sand and gravel.
Kiowa	2,599,621	2,748,992	Petroleum, natural gas, sand and gravel.
Labette	(2)	[3] 321,764	Petroleum, stone, natural gas.
Leavenworth	546,471	579,727	Stone, sand and gravel, petroleum, natural gas.
Lincoln	(2)	(2)	Stone, sand and gravel, pumice.
Linn	409,001	364,661	Petroleum, stone, sand and gravel, natural gas.
Logan	----------	1,898	Petroleum.
Lyon	882,409	[3] 533,386	Petroleum, sand and gravel.
Marion	(2)	[3] 9,228,252	Petroleum, stone, natural gas.
Marshall	594,298	720,076	Gypsum, sand and gravel, stone.
McPherson	12,377,675	10,892,731	Petroleum, natural gas, sand and gravel.
Meade	3,874,256	4,503,827	Petroleum, natural gas.
Miami	1,793,236	1,595,850	Petroleum, stone, natural gas.
Mitchell	----------	7,371	Sand and gravel.
Montgomery	6,559,943	7,143,647	Cement, petroleum, stone, natural gas, clays.
Morris	1,212,268	1,197,996	Petroleum, stone, natural gas, sand and gravel.
Morton	11,274,173	13,853,067	Petroleum, natural gas.
Nemaha	73,346	40,954	Petroleum, sand and gravel.
Neosho	7,894,205	8,190,012	Cement, petroleum, stone, natural gas.
Ness	1,726,725	1,684,083	Petroleum.
Norton	(2)	[3] 2,411,232	Petroleum, pumice, sand and gravel.
Osage	207,875	152,168	Stone, coal.
Osborne	246,815	229,436	Petroleum, sand and gravel.
Ottawa	18,842	----------	
Pawnee	7,545,706	5,276,469	Petroleum, natural gas, sand and gravel.
Phillips	6,004,924	5,693,571	Petroleum, sand and gravel.
Pottawatomie	164,510	93,838	Stone, sand and gravel.
Pratt	11,769,013	7,119,822	Petroleum, natural gas, sand and gravel.
Rawlins	23,544	242,611	Petroleum, stone.
Reno	11,515,644	12,760,901	Salt, petroleum, natural gas, sand and gravel, natural-gas liquids.
Republic	(2)	(2)	Sand and gravel.
Rice	18,600,187	16,383,787	Petroleum, salt, stone, sand and gravel, natural gas.
Riley	(2)	[3] 162,167	Petroleum, sand and gravel, stone.
Rooks	19,587,760	16,945,554	Petroleum.
Rush	2,447,045	1,777,886	Petroleum, helium, natural gas, natural-gas liquids.
Russell	26,821,783	26,684,941	Petroleum, sand and gravel, natural gas.
Saline	2,055,585	[3] 1,733,892	Petroleum, sand and gravel.
Scott	119,744	106,491	Do.
Sedgwick	12,914,877	13,603,370	Petroleum, natural-gas liquids, salt, sand and gravel, stone, natural gas.
Seward	5,285,622	4,834,133	Natural gas, natural-gas liquids, petroleum.
Shawnee	942,477	930,957	Stone, sand and gravel.
Sheridan	1,321,228	1,598,719	Petroleum, sand and gravel.
Sherman	69,198	468,066	Do.
Smith	(2)	7,650	Sand and gravel.
Stafford	18,200,799	17,217,412	Petroleum, natural gas, sand and gravel.
Stanton	2,355,946	2,642,057	Natural gas, petroleum.
Stevens	11,134,145	11,298,760	Natural gas.
Sumner	(2)	8,720,464	Petroleum, natural gas, sand and gravel.
Thomas	50,840	77,934	Sand and gravel, petroleum.
Trego	5,758,806	[3] 5,219,683	Petroleum, sand and gravel.
Wabaunsee	817,864	703,186	Petroleum, sand and gravel, stone.
Wallace	(2)	65,480	Stone, sand and gravel.
Washington	143,150	138,965	Sand and gravel.
Wichita	2,458	631	Petroleum.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Kansas, by counties [1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Wilson	$6,438,284	$6,231,684	Cement, petroleum, stone, clays, natural gas, sand and gravel.
Woodson	2,661,194	2,250,240	Petroleum, stone, natural gas.
Wyandotte	7,994,554	8,868,520	Cement, stone, sand and gravel.
Undistributed	50,896,913	6,609,977	
Total	[4] 503,788,000	500,464,000	

[1] The following counties are not listed because no production was reported in 1958 or 1959: Greeley and Lane.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Values of metals and nonmetals not included to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Revised figure.

Allen.—Allen County ranked first in cement production. Portland and masonry cements were produced by Lehigh Portland Cement Co. at Iola and Monarch Cement Co. at Humboldt. Petroleum and natural gas were recovered in the county. Miscellaneous clay for heavy clay products was mined by Humboldt Shale Mining Co. and United Brick & Tile Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural use by Nelson Bros. Quarries and Monarch Cement Co.

Anderson.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural use by Murray Limestone Products Co. and Hunt Rock Co. Anderson County Highway Department mined gravel for paving. Petroleum was produced, principally by secondary-recovery methods.

Atchison.—George W. Kerford Quarry Co., Ralph H. Bromley & Sons Quarry, and Atchison County Highway Department crushed limestone for concrete aggregate, roadstone, and riprap.

Barber.—The county ranked fifth in natural gas production and sixth in output of natural-gas liquids. Petroleum was recovered in the county. Natural-gas liquids were recovered by Skelly Oil Co. at its Medicine Lodge plant. Crude and calcined gypsum was produced by National Gypsum Co. M. W. Watson and the Barber County Highway Department mined gravel for paving.

Barton.—Barton County ranked first in value of mineral and petroleum production. Sand and gravel, mainly for building and paving, was produced by DuBois Sand Co., Moos Bros. Sand Co., Arkansas Sand Co., Klepper Sand Co., Gruber Sand Plant, and the Barton County Highway Department. Clay for heavy clay products was mined by Kansas Brick & Tile Co. and Acme Brick Co.

Bourbon.—Fort Scott Hydraulic Cement Co., Inc., produced natural and masonry cements at Fort Scott. Dimension sandstone was quarried by Bandera Stone Co. Cullor Limestone Co., Inc., Fort Scott Hydraulic Cement Co., Inc., and the Bourbon County Highway Department quarried and crushed limestone for concrete aggregate, roadstone, riprap, agricultural stone, and other uses. Coal was strip mined by Garrett Coal Co. A small quantity of petroleum and natural gas was recovered.

Butler.—Butler County ranked fourth in value of mineral and petroleum production. Secondary-recovery operations supplied a large part of the petroleum. Vickers Petroleum Co., Inc., at Potwin, produced benzene, toluene, xylenes, and higher aromatics and used catalytic reformate as raw material. Mobil Oil Co. produced select aromatic oils from petroleum fractions at its plant near Augusta. Limestone was quarried and crushed for concrete aggregate and roadstone by Myers Material, Inc.

Chase.—Limestone was quarried and crushed for concrete aggregate and roadstone by Riddle Quarries, Inc. Chase County Highway Department mined paving gravel from local deposits. Petroleum and natural gas were produced.

Chautauqua.—Petroleum and natural gas were recovered in the county. Limestone was quarried and crushed for concrete aggregate and roadstone by Sedan Limestone Co. Chautauqua County Highway Department mined paving gravel.

Cherokee.—The State's entire production of lead and zinc originated in Cherokee County. Producers included The Eagle-Picher Co., Rea Lead & Zinc Co., National Lead Co., and Ora Black. National Lead Co. dismantled its Ballard mill near Baxter Springs and moved it to southeast Missouri. The Eagle-Picher Co. obtained most of the leases previously held by National Lead Co. At Galena, The Eagle-Picher Co. operated its lead smelter and pigment plant and produced sulfuric acid by the contact method.

The county continued to rank first in coal mining. Strip mines were operated by P & M Coal Mining Co., Wilkinson Coal Co., S & M Coal Co., Inc., and Black Diamond Coal Co. Miscellaneous stone (chats) was produced by six operators. Leading producers were The Eagle-Picher Co., Baxter Chat Co., and Southwest Rock & Chat Co. Limestone for concrete aggregate and roadstone was crushed by John J. Stark. Miscellaneous clay for heavy clay products was mined by United Brick & Tile Co. A small quantity of natural gas was recovered.

Cloud.—The county ranked second in value of clay production. Fire clay for heavy clay products was mined near Concordia by Cloud Ceramics. The company reopened 10 periodic kilns during the year and increased its output to 3.5 million brick per month. Earl Beaver Sand Co. produced building sand and fill sand. Cloud County Highway Department mined paving gravel.

Cowley.—Petroleum and natural gas were produced. Silverdale Cut Stone Co., Silverdale Limestone Co., and John V. Elam prepared dimension limestone. Limestone was crushed by C. L. Daniels Stone Co. McFarland Gravel Co., Oxford Sand & Gravel Co., Myers Materials, Inc., Wilson Bros., and Warren R. Phillips produced sand and gravel from local sources.

Crawford.—The county ranked second in coal production and third in clay output. Coal was mined underground by Blue Ribbon Coal Co. and strip mined by Clemens Coal Co., Apex-Compton Coal Co., Inc., Palmer Coal Co., and Wisdom Excavating Co. Fire clay and miscellaneous clay were mined by W. S. Dickey Clay Manufacturing Co. for heavy clay products. Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by John J. Stark. Small quantities of petroleum and natural gas were produced.

Dickinson.—Dickinson County ranked second in value of stone production. Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by Anderson-Oxandale and Riddle Quarries, Inc. Sand and gravel for building and paving was produced by Shoffner Sand & Gravel Co. A small quantity of petroleum was recovered.

Doniphan.—George W. Kerford Quarry Co., Wolf River Limestone, Inc., Everett Quarries, Inc., and the U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap.

Douglas.—Sand for paving and miscellaneous uses was produced by Bowersock Mills & Power Co. near Lawrence. Limestone for concrete aggregate and roadstone was crushed by Palmyra Township Highway Department. Petroleum also was produced. Cooperative Farm Chemicals Association produced ammonia, ammonium nitrate, and nitrogen solutions, using natural gas as raw material. The company announced plans to build a $1.25 million nitric acid plant. The facility would increase the plant's capacity to 240 tons a day.

Edwards.—Petroleum and natural gas were recovered in the county. Showalter Sand & Gravel Co. mined sand for building and paving.

Elk.—Elk County ranked seventh in the value of stone production. Limestone was quarried and crushed for concrete aggregate, roadstone, railroad ballast, agricultural stone, and riprap by Concrete Materials Construction Co.

Ellis.—The county ranked second in value of mineral and petroleum production. Crushed limestone was produced by the Ellis County Highway Department and the City of Ellis Highway Department.

Ellsworth.—Rock salt was mined near Kanopolis by Independent Salt Co. Fire clay for heavy clay products was mined by Acme Brick Co. Petroleum also was recovered. San Ore Construction Co., Inc., Stoppel Construction Co., Henry Milberger, and the Ellsworth County Highway Department produced sand and gravel for building and paving.

Finney.—Natural gas was recovered from the Finney County section of the Hugoton gas area. Natural gasoline was recovered by Northern Natural Gas Co. at its plant near Holcomb. Petroleum also was recovered.

Franklin.—Buildex, Inc., mined miscellaneous clay near Ottawa and produced lightweight aggregate by the Haydite process. Petroleum was recovered mainly by secondary-recovery methods. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Dan Fogle and the Franklin County Highway Department.

Graham.—Graham County ranked fifth in value of mineral and petroleum production. Paving sand and gravel was produced by San Ore Construction Co.

Grant.—The county ranked first in output of natural-gas liquids and second in that of natural gas. All natural gas was recovered from the Hugoton gas area. Columbian Carbon Co., at Hickok, and United Carbon Co., at Ryus, produced the State's entire output of carbon black. Hugoton Production Co., Mobil Oil Co., and Pan American

Petroleum Corp. produced natural gasoline, butane, and propane. Petroleum also was recovered.

Greenwood.—Petroleum was produced in Greenwood County, largely by secondary-recovery methods. Greenwood County Highway Department and Sedan Limestone Co. quarried and crushed limestone for concrete aggregate and roadstone. Gravel was mined for paving.

Haskell.—Natural gasoline was recovered by Northern Natural Gas Co. at its plant near Sublette. Petroleum, natural gas, and sand and gravel were produced.

Johnson.—Johnson County ranked third in value of stone production. Limestone was quarried and crushed for concrete aggregate and roadstone by Reno Construction Co., J. A. Togan Construction Co., Deitz Hill Development Co., and the Johnson County Highway Department. A small quantity of dimension limestone was produced. Petroleum and natural gas were recovered.

Kearny.—The county ranked fourth in natural gas output and fifth in natural-gas liquids production. A small quantity of petroleum was recovered. Kansas-Nebraska Natural Gas Co. recovered natural gasoline, propane, and LP-gases at Deerfield; Colorado Interstate Gas Co. recovered natural gasoline at Lakin. Popejoy Sand & Gravel Co. and the Kearny County Highway Department mined sand and gravel from local deposits.

Kingman.—Kingman County ranked fourth in recovery of natural-gas liquids. Natural gasoline, butane, and propane were recovered by Mobil Oil Co. at Spivey. Petroleum and natural gas were produced. Sand for building was mined by Ray Wells.

Lincoln.—Sandstone was quarried for filter beds, concrete aggregate, roadstone, railroad ballast, and riprap by Quartzite Stone Co. San Ore Construction Co., Inc., produced paving sand and gravel. Ernest Hanzlicek mined pumice.

Marshall.—Bestwall Gypsum Co. mined and processed gypsum at Blue Rapids. The company began constructing a plant to replace facilities which were to be inundated by the reservoir of Tuttle Creek Dam. The new facilities were to include an additional unit for the production of gypsum board and lath and would handle a 100-percent increase in the company's mining production. Blue River Sand & Gravel Co., Heinzelman Construction Co., C. V. Garrett, Hugo P. Vogler, and the Marshall County Highway Department produced sand and gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Hopper Bros. Quarries and Swanson Construction Co.

Montgomery.—The county ranked fourth in cement production and fifth in clay output. Portland and masonry cements were manufactured by Universal Atlas Cement, a division of United States Steel Corp., at its Independence plant. Petroleum and natural gas were recovered. In addition to clay used for cement, miscellaneous clay for making heavy clay products was mined by United Brick & Tile Co. Crushed limestone for concrete aggregate, roadstone, and agricultural stone was produced by H & S Rock Co., Universal Atlas Cement, Division of United States Steel Corp., the Montgomery County Highway Department, and the city of Coffeyville. A small quantity of dimension limestone also was produced. Barium monohydrate and barium carbonate were produced by Ozark Smelting & Mining Co., a subsidiary of Sherwin-Williams Co., at Coffeyville. Cherryvale Zinc Co. operated its pigment plant near Coffeyville.

Morton.—Morton County ranked third in natural-gas production. The output came mainly from the Greenwood and Hugoton gas areas. Petroleum also was recovered.

Neosho.—The county ranked second in cement production and shipments and sixth in stone production. Ash Grove Lime & Portland Cement Co. produced portland and masonry cements. Petroleum and natural gas were recovered. A large part of the petroleum was recovered by secondary recovery methods. Harry Byers & Sons, Inc., produced crushed and dimension limestone. O'Brien Rock Crusher, Anderson-Oxandale, and the Neosho County Highway Department crushed limestone.

Norton.—Pumice was mined at Calvert by Wyandotte Chemical Corp. for use in cleaning and scouring products. Petroleum also was recovered. Norton County Highway Department mined gravel for paving.

Osage.—Osage Couny ranked third in coal production. Coal was mined underground by Bell Coal Co. and from strip pits by Johnson Coal Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Clark Rock Quarry and K. B. Dusenbury, Inc.

Reno.—Reno County ranked first in salt output and seventh in sand and gravel production. Morton Salt Co., Carey Salt Co., and Barton Salt Co. produced evaporated salt. Rock salt was mined by Carey Salt Co. Barton Salt Co. began constructing a six-story screening and storage plant to separate salt by crystal size. Bins in the new plant will hold 600 tons of finished salt. Petroleum, natural gas, and natural-gas liquids were recovered. Cities Service Oil Co. recovered natural gasoline, propane, and LP-gases at its Burrton plant. J. E. Steele Sand & Gravel Co., J. N. Shears Sons, Inc., J. A. Mummey Sand & Gravel, Fountain Sand Pit, Haven Sand Co., and the City of Hutchinson produced sand and gravel.

Rice.—The county ranked ninth in value of mineral and petroleum output. Evaporated and rock salt were produced at Lyons by American Salt Co. The company completed a $750,000 modernization program at its plant. Natural gas was recovered. Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Riddle Bros. Quarries. Sand and gravel was produced by Rock Hill Stone & Gravel Co.; Tobias, Wright, and Birchenough, Inc.; Arensman Sand & Gravel Co.; Sterling Sand & Gravel Co.; and A. L. Stapleton.

Rooks.—The county ranked eighth in value of mineral and petroleum production.

Rush.—Petroleum, natural gas, natural-gas liquids, and helium were recovered. Natural gasoline and butane were recovered by Dunn-Mar Oil & Gas Co. at its Otis plant. Helium was recovered from natural gas at Otis by the Federal Bureau of Mines.

Russell.—Russell County ranked third in value of mineral and petroleum output. Natural gas was recovered. Russell County Highway Department produced paving sand and gravel.

Saline.—The county ranked fifth in production of sand and gravel. Salina Sand Co., Inc., and Central Kansas Sand Co. mined sand and gravel for building, paving, and other uses. Petroleum was recovered.

Sedgwick.—Sedgwick County ranked second in output of natural gas liquids and sand and gravel. Plateau Natural Gas Co. recovered natural gasoline and LP-gases at its Cheney plant. Cities Service Oil Co. recovered natural gasoline, propane, and LP-gases at its Wichita plant. Petroleum and natural gas were recovered. Sand and gravel was produced by the City of Wichita and 12 commercial operators. Leading producers were: Dolese Bros. Co., Superior Sand Co., Miles Sand Service, Walt Keeler Co., Inc., and Bently Sand Co. Limestone was crushed for concrete aggregate and roadstone by the City of Wichita. Frontier Chemical Co., a division of Vulcan Materials Co., pumped brine from wells and manufactured chlorine, caustic soda, and salt. These materials were used to produce chloroform, wood preservatives, carbon tetrachloride, and grain fumigants. Dodson Manufacturing Co., Inc., exfoliated vermiculite for use in insulation, plaster, concrete roof decks, and floors.

Seward.—Seward County ranked third in production of natural gas liquids. Natural gas, mainly from the Hugoton gas area, and petroleum were recovered. Natural gasoline, butane, and propane were recovered by Panhandle Eastern Pipe Line Co. at its Liberal plant.

Shawnee.—Shawnee County ranked third in value of sand and gravel output. Building, paving, and fill sand and gravel and blast and engine sand were produced. Producers included Kansas Sand Co., Inc., Consumers Sand Co., Victory Sand & Gravel Co., River Sand Co., and Shoffner Sand, Inc.

Stafford.—The county ranked seventh in value of mineral and petroleum production. Natural gas was recovered. Partin Sand & Gravel Co. and the Stafford County Highway Department produced sand and gravel for building and paving.

Stevens.—The county continued as the leading producer of natural gas. All production came from the Hugoton gas area.

Trego.—Petroleum and sand and gravel were produced. The county ranked fifth in sand and gravel production. San Ore Construction Co., Inc., and Trego County Highway Department mined paving sand and gravel.

Wallace.—DeLore Division of National Lead Co. produced diatomaceous marl for use as a flatting pigment in paint. Harry Henery, Inc., mined paving gravel, and Wallace County Highway Department produced paving and building sand.

Wilson.—General Portland Cement Co. (formerly Consolidated Cement Corp.) manufactured portland and masonry cements at Fredonia. Carr Rock Products Co. and Benedict Rock & Lime Co. quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Gravel for paving was produced by the Wilson County Highway Department. Acme Brick Co., at Buffalo, and Excelsior Brick Co., at Fredonia, mined miscellaneous clay for heavy clay products. Petroleum and natural gas were recovered.

Wyandotte.—The county ranked first in output of stone and sand and gravel. Thompson-Strauss Quarries, Inc., Peerless Quarries, Inc., American Rock Crusher Co., and J. A. Tobin Construction Co. quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and asphalt base. Sand and gravel was produced by eight operators; leading producers were Stewart Sand & Material Co., Holliday Sand & Gravel Co., Builders Sand Co., American Sand & Gravel Co., and Peck-Woolf Sand & Material Co. Portland and masonry cements were manufactured by Lone Star Cement Corp. Perlite was expanded by Panacalite Perlite, Inc., using crude ore shipped from the Western States. Reichhold Chemicals, Inc. produced phenolformaldehyde resins, polyvinyl acetate emulsions, and formaldehyde at its plant in Kansas City, Kans.

The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Kentucky Geological Survey.

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RECORD production of petroleum, crushed limestone, and cement highlighted the mineral industry of Kentucky in 1959. Coal production continued to decline, reaching the lowest level since 1954. Among the States, Kentucky was second in ball clay and fluorspar production and third in bituminous-coal output. The total value of mineral production increased 4 percent, but was 17 percent below 1948, which was the record year.

Coal mining dominated the mineral industry of the State and supplied 65 percent of the total value of production, compared with 72 percent in 1958 and 75 percent in 1957. Other fuels (natural gas, crude petroleum, and natural-gas liquids) supplied 25 percent, compared with 20 percent in 1958 and 18 percent in 1956. Leading producing companies were Peabody Coal Co., United States Steel Corp., and Bethlehem Mines, Inc.

TABLE 1.—Mineral production in Kentucky[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Barite .... short tons	....	....	26,598	$335
Clays	737	$2,957	984	3,595
Coal	66,312	289,385	62,810	270,139
Fluorspar .... short tons	25,861	1,201	18,579	887
Gem stones	(2)	(3)	(2)	(3)
Lead (recoverable content of ores, etc.) .... short tons	516	121	409	94
Natural gas .... million cubic feet	72,248	17,412	[4] 72,400	[4] 17,600
Natural-gas liquids:				
Natural gasoline .... thousand gallons	37,926	2,165	35,868	2,133
LP-gases .... do	150,655	8,491	213,171	12,267
Petroleum (crude) .... thousand 42-gallon barrels	17,509	51,652	[4] 26,343	[4] 74,024
Sand and gravel	4,685	4,835	5,081	5,568
Silver (recoverable content of ores, etc.) .... troy ounces	99	(3)	75	(3)
Stone	12,597	17,360	[5] 16,063	[5] 22,215
Zinc (recoverable content of ores, etc.) .... short tons	1,258	257	673	155
Value of items that cannot be disclosed: Nonmetals	....	7,059	....	8,202
Total Kentucky[6]	....	402,121	....	416,391

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Excludes crushed sandstone, included with "Value of items that cannot be disclosed."
[6] Total adjusted to eliminate duplicating the value of clays and stone.

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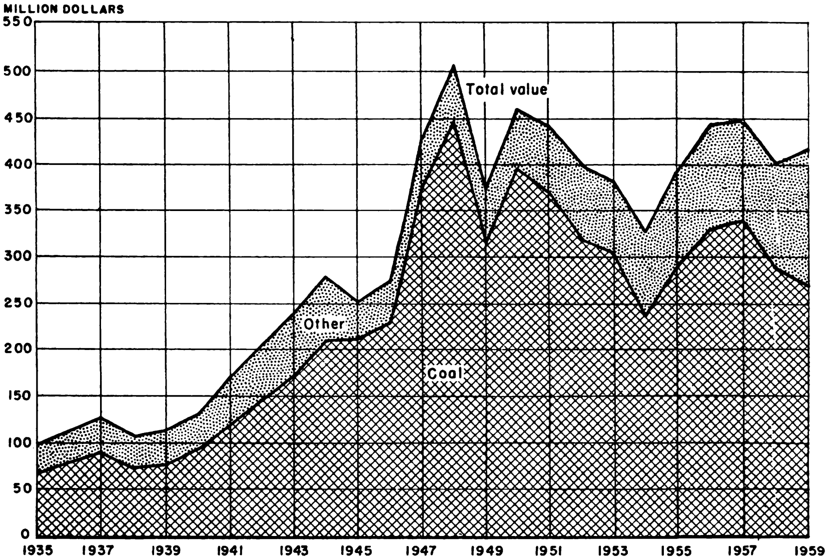

FIGURE 1.—Value of coal and total value of all minerals produced in Kentucky, 1935–59.

Employment and Injuries.—Total employment, excluding oil and gas, declined 10 percent below 1958, owing mainly to lower coal output. The number of men employed in coal mining dropped 6,957, and employment fell 15 percent. During the last 2 years the decrease in men at coal mines was 10,247 (28 percent); during the same period the decrease in coal production was 11,857,000 tons (16 percent). Employment increased 23 percent at quarries and mills, and 18 percent at sand and gravel mines, owing mainly to increased use of aggregates for roads. Most companies worked a 5-day week, but nonmetal mines averaged a 4-day week, and coal mines averaged 3 days a week.

Injury experience was about the same as in 1958. Coal mines, quarries and mills, and nonmetal mines had lower frequency rates. Forty-six fatalities occurred, compared with 55 in 1958 (excluding oil and gas).

Trends and Developments.—The National System of Interstate and Defense Highways Program was partly responsible for increased production of aggregates. Of a total of 700 miles of four-lane, limited-access highways designated for the State, 13 miles were completed during the year, 98 miles were under construction, plans were approved for 8 miles, and 27 miles were programed.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
	1958						
Oil and gas	(1)	4,604	258	9,501,980	4	157	17
Coal mines	2,310	32,921	168	43,778,600	49	2,036	48
Quarries and mills	100	2,163	233	4,028,534	4	153	39
Nonmetal mines	41	536	198	846,655		33	39
Sand and gravel mines	33	465	261	972,405	2	8	10
Coke ovens and smelters	2	314	345	866,536		3	3
Total	(1)	41,003	184	59,994,710	59	2,390	41
	1959 [2] [3]						
Coal mines	2,105	25,964	178	37,155,247	44	1,702	47
Quarries and mills	100	2,481	250	4,968,741	1	158	32
Nonmetal mines	66	833	218	1,454,648		36	25
Sand and gravel mines	32	493	291	1,146,762	1	12	11
Coke ovens and smelters	2	311	343	852,198		3	4
Total	2,305	30,082	189	45,577,596	46	1,911	43

[1] Data not available.
[2] Preliminary figures.
[3] Excludes oil and gas, data not available.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Coal production continued the decline that began in 1957. Total production decreased 5 percent below 1958 and 25 percent below 1947 (the record year), to the lowest level since 1954. The loss in coal production was all in Eastern Kentucky. Bituminous coal was mined at 1,724 mines in 43 counties, compared with 2,015 mines in 43 counties in 1958. Leading counties were Hopkins, Muhlenberg, and Harlan. Leading producing companies were Peabody Coal Co., United States Steel Corp., Bethlehem Mines, Inc., Nashville Coal Co., and Inland Steel Co.

During the year TVA executed several long-term contracts for large tonnages of coal from Western Kentucky mines.

TVA announced plans for constructing the world's largest powerplant, to be located on a coal deposit at Paradise, on the bank of Green River. Peabody Coal Co. was to open the world's largest strip mine at the plant, using machinery larger than any now in use.

In the Eastern Kentucky coalfield, 1,609 mines in 31 counties produced 33,194,000 tons, compared with 1,880 mines, 31 counties, and 38,231,000 tons in 1958. Average production per mine increased from 20,300 to 20,600 tons. Underground mines produced 89 percent of the total, auger mines produced 6 percent, and strip mines produced 5 percent. Shipments were 86 percent by rail or water and 14 percent by truck. Captive tonnage was 20 percent of the total.

Equipment used at 1,448 underground mines included 999 cutting machines, which cut 80 percent of the tonnage; 1,447 power drills, which drilled 85 percent; 896 locomotives, 1,081 shuttle cars, 139 rope hoists, and 121 mother conveyors; 295 mobile loading machines, which loaded 55 percent of the tonnage; 44 continuous mining machines, which loaded 10 percent, and 49 face conveyors, which loaded 1 percent.

Equipment used at 81 strip mines included 111 power shovels, 2 draglines, 2 carryall scrapers, 93 bulldozers, 40 power drills, and 233 trucks. An estimated 17,682,000 cubic yards of overburden was excavated.

Equipment used at 80 auger mines included 83 coal-recovery augers, 9 power shovels, 1 carryall scraper, 49 bulldozers, 6 power drills, and 125 trucks.

Forty-three cleaning plants cleaned 50 percent of the total production of coal; 31 percent was crushed, and 26 percent was treated with oil.

In the Western Kentucky coalfield, 115 mines in 12 counties produced 29,616,000 tons, compared with 135 mines, 12 counties, and 28,081,000 tons in 1958. Average production per mine increased from 208,000 to 258,000 tons. Underground mines produced 41 percent of the total, and strip mines 59 percent. Shipments were 96 percent by rail or water and 4 percent by truck. All coal was sold in open market.

Equipment used at 59 underground mines included 139 cutting machines, which cut 99 percent of the tonnage; 128 power drills, which drilled 99 percent; 109 locomotives, 255 shuttle cars, 23 rope hoists, and 75 mother conveyors; 120 mobile loading machines, which loaded 96 percent, and 3 continuous miners, which loaded 1 percent.

Equipment used at 54 strip mines included 99 power shovels, 43 draglines, 5 carryall scrapers, 107 bulldozers, 82 power drills, and 318 trucks. An estimated 130,028,000 cubic yards of overburden was excavated.

Equipment used at two auger mines included two coal-recovery augers, one bulldozer, one power drill, and six trucks.

Thirty-eight cleaning plants cleaned 86 percent of the total production of coal; 49 percent was crushed, and 22 percent was treated with oil or calcium chloride.

Natural Gas.—Marketed production of natural gas was about the same as in 1958 and was 25 percent below 1947, the record year. During the year 212 producing gas wells were drilled. At the end of the year, 4,689 gas wells were producing. Cumulative natural gas production for the State since 1883 was 2,004,000 million cubic feet.

TABLE 3.—Coal production by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Bell	1,186,071	$4,475,196	1,119,310	$4,359,331
Boyd	289,468	1,138,040	116,366	529,430
Breathitt	714,588	4,292,749	588,730	3,573,591
Butler	172,216	588,782	202,802	803,716
Caldwell	----------	----------	35,857	107,573
Carter	236,058	1,458,838	48,226	233,900
Christian	(1)	(1)	36,061	181,386
Clay	1,101,550	4,305,186	1,022,831	4,219,978
Clinton	26,022	94,980	22,642	95,322
Daviess	(1)	(1)	804,004	2,328,055
Edmonson	1,795	5,923	----------	----------
Elliott	15,992	61,729	12,406	49,624
Floyd	4,263,325	25,049,559	3,744,379	21,717,006
Grayson	1,586	7,930	----------	----------
Greenup	3,100	15,655	9,635	48,656
Hancock	22,792	75,213	5,367	23,528
Harlan	6,939,434	40,500,968	5,205,160	30,987,702
Henderson	241,629	704,144	281,790	851,037
Hopkins	11,428,069	42,966,594	11,124,717	41,817,057
Jackson	131,345	545,238	138,385	611,661
Johnson	304,800	1,061,316	257,044	953,632
Knott	1,482,764	4,745,696	1,071,897	3,456,359
Knox	198,483	740,812	106,140	348,353
Laurel	250,978	1,024,518	337,123	1,362,934
Lawrence	60,371	241,484	42,787	194,681
Lee	113,522	479,346	113,497	544,066
Leslie	2,659,553	10,905,743	2,813,167	12,040,229
Letcher	5,742,943	30,346,445	3,843,184	20,686,903
Magoffin	73,460	247,634	187,266	445,035
Martin	49,531	163,948	55,281	187,955
McCreary	470,026	1,890,901	526,243	2,125,453
McLean	----------	----------	1,200	3,912
Morgan	46,936	231,307	129,778	614,886
Muhlenberg	8,852,076	29,216,369	9,821,537	32,816,499
Ohio	2,785,368	9,299,036	3,294,916	10,649,271
Owsley	1,649	6,415	41,823	153,490
Perry	4,789,843	21,997,814	4,087,528	18,857,227
Pike	6,405,577	31,639,976	6,876,190	35,037,528
Pulaski	187,138	659,266	203,826	754,048
Rockcastle	49,781	172,772	107,590	369,041
Union	2,098,543	8,755,781	2,735,435	10,927,108
Wayne	14,655	134,240	7,226	44,006
Webster	1,528,025	4,585,588	1,271,840	3,836,156
Whitley	414,152	1,611,012	345,863	1,131,738
Wolfe	8,000	40,000	12,800	60,260
Undistributed	948,591	2,900,922	----------	----------
Total	66,311,805	289,385,065	62,809,849	270,139,323
Earliest record to date	2,581,933,000	(2)	2,644,743,000	(2)

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed".
[2] Data not available.

Natural-Gas Liquids.—*Natural Gasoline.*—Production of natural gasoline decreased 5 percent below 1958, the record year.

LP-Gases.—Production of liquefied-petroleum (LP) gases increased 41 percent over 1958 but was 14 percent below 1956, the record year.

Petroleum.—Production of crude petroleum increased 50 percent over 1958 and 49 percent over 1956, the record year. During the year 2,522 producing oil wells were drilled, 296 in Western Kentucky, 2,134 in Central Kentucky, and 92 in Eastern Kentucky. In addition, 1,821 dry holes were drilled. At the end of the year, 13,899 oil wells were producing. The outstanding development was the great increase in production in Greene and Taylor Counties. Significant discoveries were made in Lincoln and Metcalf Counties. Leading counties were Greene, Henderson, and Daviess, compared with Henderson, Daviess, and Union in 1958.

TABLE 4.—Production of crude petroleum by counties, in barrels[1]

County	1958		1959	
	Barrels	Value	Barrels	Value
Adair			80	$231
Allen	67,127	$198,025	80,959	233,972
Barren	56,096	165,483	41,868	120,999
Bath	5,403	15,939	5,462	15,785
Bell	449	1,325	746	2,156
Boyd	754	2,224	664	1,919
Breathitt	301,689	889,983	481,047	1,390,226
Breckinridge	90,963	268,341	40,792	117.889
Butler	279,225	823,714	464,347	1,341,963
Christian	703,470	2,075,237	890,307	2,572,987
Clinton	64,966	191,650	82,272	237,766
Crittenden	710	2,095	661	1,910
Cumberland	18,951	55,905	32,056	92,642
Daviess	1,835,526	5,414,802	1,818,744	5,256,170
Edmonson			1,184	3,422
Elliott	129,016	380,597	112,704	325,714
Estill	125,248	369,482	116,708	337.286
Floyd	19,588	57,785	18,472	53,384
Grayson			326	942
Green	1,656,049	4,885,345	8,488,504	22,424,067
Greenup	1,605	4,735	906	2,618
Hancock	415,086	1,224,504	382,517	1,105,474
Hardin			35,211	101,760
Harlan	73	216		
Hart	24,288	71,650	18,154	52,465
Henderson	2,512,856	7,412,925	3,314,852	9,579,922
Hopkins	119,659	352.994	80,362	232,246
Jackson	853	2,516	506	1,462
Johnson	212,103	625,704	173,766	502,184
Knott	17,200	50,740	13,755	39,752
Knox	2,427	7,160	1,785	5,159
Laurel	507	1,496	552	1,595
Lawrence	205,354	605,795	279.277	807,111
Lee	802,148	2,366,337	822,772	2,377,811
Leslie	3,600	10,620	3,997	11,551
Letcher	43	127	1,751	5,060
Lincoln	1,787	5,272	47,773	138,064
Logan	3,418	10,083	2,323	6,713
Magoffin	1,611,883	4,755,055	1,392,105	4,023,183
Martin	24,296	71,673	22,037	63.687
McCreary	1,310	3,865	1.039	3,003
McLean	969,137	2,858,954	744,689	2,152,151
Menifee	487	1,437	1,314	3,797
Metcalfe	65	192	326,499	943,582
Monroe	80	236	119	344
Montgomery			283	818
Morgan	929	2,741	905	2,615
Muhlenberg	867,458	2.559.001	784.651	2,267,497
Ohio	1,073,464	3,166.719	1,000,025	2,890,072
Owsley	1,334	3,935	896	2,589
Perry	385	1,136	466	1,347
Pike	60,635	178,874	53,656	155,066
Powell	80,258	236,761	108,239	312,811
Russell	195	575	7,628	22,045
Simpson	18,569	54,779	29,386	84,926
Taylor	277	817	1,095,995	3,167,426
Todd	7,479	22,063	6,320	18,265
Union	1,766,456	5,211,045	1,692,223	4,890,524
Warren	48,134	141,996	45,589	131,752
Wayne	16,352	48,238	23,079	66,698
Webster	1,217,992	3,593,077	1,092,077	3,156,103
Whitley			5,196	15,016
Wolfe	63,588	187,585	50,422	145,720
Total	17,509,000	51,652,000	26,343,000	74,024,000
Earliest record to date	368,779,000	800,182,000	395,122,000	874,206,000

[1] Data from Kentucky Geological Survey.

NONMETALS

Barite.—J. Willis Crider Fluorspar Co. and Mico Mining & Milling Co. mined crude barite in Crittenden County for oil well drilling and for chemicals. This was the first production for the State since 1943, and exceeded any previous year. Cumulative production for the State since 1902 was 27,600 tons valued at $344,400.

Cement.—Kosmos Portland Cement Co. operated the Kosmosdale plant throughout the year. Shipments of masonry cement increased 21 percent over 1958 and 13 percent over 1955, the previous record year. Shipments of portland cement increased 20 percent over 1958 and 18 percent over 1956, the previous record year. Raw materials used in portland cement included limestone (74 percent), miscellaneous clay (22 percent), gypsum (2 percent), and pyrite (2 percent). Cement produced was mainly consumed within the State, but shipments were made to Ohio and Indiana.

Clays.—*Ball Clay.*—Kentucky ranked second among the States in ball-clay production. Ball clay was mined by four companies in Graves County and sold for use in whiteware, stoneware, art pottery, floor and wall tile, firebrick and block, fire-clay mortar, kiln furniture, other refractories, plastics, and for export. Leading producers were Kentucky-Tennessee Clay Co. and Old Hickory Clay Co. Production increased 18 percent, but was 3 percent below 1956, the record year. Total production was 111,600 tons valued at $1,519,000.

Fire Clay.—Fifteen companies mined fire clay at 29 mines in Carter, Greenup, and Rowan Counties for firebrick and block, fire-clay mortar, and heavy clay products. Leading producers were General Refractories Co., Harbison-Walker Refractories Co., and North American Refractories Co. Production increased 31 percent but was 44 percent below 1951, the record year. Total production was 247,400 tons valued at $1,257,300.

Miscellaneous Clay.—Thirteen companies mined miscellaneous clay at 17 mines in 10 counties for floor and wall tile, heavy clay products, lightweight aggregate, and cement. Leading counties were Jefferson, Hancock, and Bullitt. Leading producers were Kenlite Division of Kentucky Light Aggregates, Inc., Kosmos Portland Cement Co., and Cannelton Sewer Pipe Co. Production increased 38 percent over 1958 and 29 percent over 1956, the previous record year. Total production was 625,000 tons valued at $818,000.

Fluorspar.—Nine companies or individuals mined fluorspar in Caldwell, Crittenden, and Livingston Counties for hydrofluoric acid, glass, steel manufacture, and iron foundries. Leading producers were Calvert City Chemical Co. (Dyers Hill mine), and Craighead & Coates (Stallions mine). Marketable production declined 34 percent below 1958 and 83 percent below 1941, the record year. Total marketable production was 16,700 tons valued at $806,900. Total cumulative production from earliest records was 2,857,000 tons. Five companies processed or blended fluorspar purchased in Illinois, Kentucky, or Mexico for shipment to consumers; the leading shipper was Kentucky Fluorspar Co.; total shipments to consumers from Kentucky were 29,400 tons valued at $1,367,000. Total shipments originating in Kentucky were 18,600 tons valued at $886,600. Among the States, Kentucky ranked second in fluorspar production. During the year, two new fluorspar mines were opened, the Stallions mine in Crittenden County, and the Atwood mine in Livingston County. Calvert City Chemical Co. started sinking its main shaft from 350 to 470 feet.

Gem Stones.—Fluorite and other specimens were collected in Crittenden, Henry, Livingston, and other counties for sale to dealers. Total value reported was $310.

Sand and Gravel.—Twenty-two companies mined sand and gravel at 32 mines in 20 counties. Leading counties were Jefferson, Henderson, Boone, and Carroll. Leading producers were Standard Materials Corp., Bedford-Nugent Co. Inc., and Ohio River Sand Co. Inc. Production increased 8 percent but was 11 percent below 1956, the record year. Of the total production, 91 percent was washed, and 67 percent was hauled by truck, 29 percent by water, and 4 percent by rail. During the year, Murray Sand Co. began marketing a high-purity industrial sand from a deposit near Murray.

TABLE 5.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Ballard	22,720	$18,340	20,343	$14,970
Boone	(1)	(1)	(1)	(1)
Calloway	11,300	11,400	44,227	54,742
Carlisle	24,000	20,350	19,828	12,700
Carroll	(1)	(1)	(1)	(1)
Daviess	(1)	(1)	230,714	308,021
Floyd	(1)	(1)	(1)	(1)
Fulton	(1)	(1)	(1)	(1)
Gallatin	(1)	(1)	(1)	(1)
Graves	68,214	53,814	79,419	57,700
Greenup	(1)	(1)	-----	-----
Hancock	(1)	(1)	-----	-----
Henderson	(1)	(1)	(1)	(1)
Hickman	36,150	32,837	35,563	27,200
Jefferson	2,394,893	2,507,285	1,962,533	2,036,984
Livingston	16,680	16,780	8,325	8,075
Lyon	2,100	1,827	14,326	9,450
Marion	1,000	1,000	-----	-----
Marshall	22,500	14,319	29,987	21,200
Mason	53,450	84,170	70,260	112,416
McCracken	(1)	(1)	445,850	558,000
Pike	(1)	(1)	5,000	5,300
Union	30,000	37,500	34,000	42,500
Undistributed	2,002,087	2,035,557	2,080,434	2,298,648
Total	4,685,094	4,835,179	5,080,809	5,567,906

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 6.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,544,802	$1,652,572	$1.07	2,038,123	$2,255,856	$1.11
Paving	828,699	796,304	.96	943,884	969,618	1.03
Fill	-----	-----	-----	194,830	182,265	.94
Glass	-----	-----	-----	7,621	23,600	3.10
Molding	(1)	(1)	(1)	1,835	6,400	3.49
Other sand	(1)	(1)	(1)	(1)	(1)	(1)
Gravel:						
Paving	701,389	680,521	.97	949,508	990,297	1.04
Structural	930,766	1,083,994	1.16	851,236	1,079,210	1.27
Other gravel	(1)	(1)	(1)	(1)	(1)	(1)
Total sand and gravel	4,685,094	4,835,179	1.03	5,080,809	5,567,906	1.10

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Total sand and gravel."

Stone.—Seventy-four operators crushed limestone at 95 quarries in 59 counties. Leading counties were Jefferson, Livingston, and Hardin. Leading producers were Kentucky Stone Co. (Anderson, Breckenridge, Hardin, Jessamine, Lee, Logan, Madison, Rockcastle, and Todd Counties), Reed Crushed Stone Co. Inc. (Livingston County) and Louisville Crushed Stone Co. (Jefferson County). Production increased 28 percent over 1958 and 26 percent over 1957, the previous record year. Of the total, 90 percent was hauled by truck, 7 percent by rail, and 3 percent by water. During the year, Vulcan Materials Co. acquired Okolona Stone Co., Ralph E. Mills Co., Talbott Construction Corp., and Talco Constructors, Inc., which will operate under Lambert Brothers Division.

Levi Polly crushed a small quantity of sandstone in Bell County for concrete and roads. Four companies quarried 2,400 tons of dimension sandstone in Livingstone, Logan, and McCreary Counties for rough architectural and dressed building stone and for flagging. Leading producer was Kentucky Flagstone Co.

Vermiculite.—Zonolite Co. exfoliated vermiculite from South Carolina and Montana at the Wilder plant.

METALS

Aluminum.—Aluminum Company of America purchased additional property along the Ohio and Tradewater Rivers, to meet long-range plans for a future plant.

Ferroalloys.—Shipments of ferroalloys, including ferromanganese, silicomanganese, silvery iron, ferrosilicon, ferrochromium, and ferrochromic-silicon increased 21 percent.

Lead.—Byproduct recovery of lead from fluorspar milling decreased 21 percent.

Pig Iron and Steel.—Armco Steel Corp. produced foundry and basic pig iron at Ashland; shipments declined 24 percent. Steel was produced by Armco Steel Corp. and by Acme Steel Co. at Newport. Iron ore consumed was 3 percent domestic and 97 percent imported. Imports, mainly from Labrador and Brazil, decreased 4 percent below 1958, the record year.

Silver.—A small quantity of silver was recovered from lead and zinc concentrates.

Zinc.—Byproduct recovery of zinc from fluorspar milling declined 47 percent below 1958 and 81 percent below 1951, the record year. Table 9 shows zinc production from the earliest records to 1959.

TABLE 7.—Crushed limestone sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Adair	156,104	$234,156	(1)	(1)
Allen	(1)	(1)	(1)	(1)
Anderson	110,439	144,521	(1)	(1)
Barren	85,000	117,000	138,000	$200,000
Bourbon	103,874	134,380	(1)	(1)
Boyle	181,222	230,166	439,265	565,192
Breckinridge	(1)	(1)	(1)	(1)
Butler	103,724	158,847	(1)	(1)
Caldwell	(1)	(1)	(1)	(1)
Carter	(1)	(1)	(1)	(1)
Casey	(1)	(1)	(1)	(1)
Christian	(1)	(1)	(1)	(1)
Clark	(1)	(1)	(1)	(1)
Clinton	77,290	115,935	(1)	(1)
Crittenden	(1)	(1)	(1)	(1)
Edmonson	(1)	(1)	(1)	(1)
Estill	(1)	(1)	50,000	75,000
Fayette	442,624	756,203	704,402	1,037,063
Fleming	(1)	(1)	(1)	(1)
Franklin	442,290	553,090	714,561	889,601
Garrard	-----	-----	(1)	(1)
Grayson	(1)	(1)	(1)	(1)
Green	(1)	(1)	-----	-----
Hardin	841,562	1,177,518	784,020	1,124,404
Harlan	(1)	(1)	(1)	(1)
Harrison	(1)	(1)	(1)	(1)
Hart	130,400	173,000	118,000	150,120
Jackson	(1)	(1)	(1)	(1)
Jefferson	1,487,676	2,057,837	2,097,594	2,908,845
Jessamine	96,660	108,239	(1)	(1)
Kenton	9,568	16,644	9,356	16,372
Lee	(1)	(1)	(1)	(1)
Letcher	(1)	(1)	(1)	(1)
Lincoln	-----	-----	143,248	179,060
Livingston	(1)	(1)	(1)	(1)
Logan	153,148	218,101	(1)	(1)
Madison	97,351	101,439	(1)	(1)
Marion	134,000	203,500	(1)	(1)
Meade	(1)	(1)	(1)	(1)
Menifee	121,978	211,239	160,800	267,910
Mercer	157,574	299,011	113,331	168,636
Metcalfe	(1)	(1)	(1)	(1)
Monroe	(1)	(1)	(1)	(1)
Morgan	(1)	(1)	(1)	(1)
Muhlenberg	(1)	(1)	159,875	184,843
Nelson	(1)	(1)	(1)	(1)
Nicholas	(1)	(1)	14,515	28,630
Ohio	(1)	(1)	(1)	(1)
Oldham	(1)	(1)	(1)	(1)
Pendleton	(1)	(1)	(1)	(1)
Pike	-----	-----	(1)	(1)
Powell	99,883	158,850	51,560	79,650
Pulaski	(1)	(1)	(1)	(1)
Rockcastle	394,882	507,262	(1)	(1)
Rowan	(1)	(1)	(1)	(1)
Simpson	(1)	(1)	114,000	154,900
Todd	(1)	(1)	(1)	(1)
Trigg	51,137	68,000	34,125	34,125
Warren	364,888	541,523	406,638	582,919
Wayne	(1)	(1)	(1)	(1)
Undistributed	6,745,057	9,023,000	9,807,118	13,526,340
Total	12,588,331	17,309,461	16,060,408	22,173,610

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[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed".

TABLE 8.—Crushed limestone sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	10,413,322	$14,517,280	$1.39	13,780,571	$19,166,557	$1.39
Agstone	1,113,251	1,477,520	1.33	1,297,678	1,690,223	1.30
Railroad ballast	397,377	416,781	1.05	346,963	379,326	1.09
Riprap	10,685	11,750	1.10	(1)	(1)	(1)
Other uses [2]	653,696	886,130	1.36	635,196	937,504	1.48
Total	12,588,331	17,309,461	1.38	16,060,408	22,173,610	1.38

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."
[2] Includes riprap, fluxing stone, asphalt filler, stone sand, cement, and other uses.

TABLE 9.—Mine production of recoverable zinc, 1901–59

Year	Short tons	Value	Year	Short tons	Value
1901	1,130	$113,000	1933	228	$32,176
1902	1,680	168,000	1934	125	18,446
1903	540	54,000	1935	127	21,736
1904	390	39,000	1936	238	23,800
1905	160	16,000	1937	270	35,100
1906	160	16,000	1938	322	30,912
1907	358	42,244	1939	909	94,536
1908	341	32,054	1940	1,278	161,028
1909	64	6,912	1941	427	64,050
1910	6	648	1942	407	75,702
1911	158	18,012	1943	931	201,096
1912	491	67,758	1944	341	77,748
1913	327	36,624	1945	182	41,860
1914	230	23,460	1946	314	76,616
1915	764	189,472	1947	508	122,936
1916	1,096	293,728	1948	639	169,974
1917	751	153,204	1949	935	231,880
1918	315	57,330	1950	731	207,604
1919	36	5,256	1951	3,457	1,258,348
1920	9	1,458	1952	3,280	1,088,960
1921	220	22,000	1953	489	112,470
1922	142	16,188	1954	458	98,928
1923	270	36,720	1955	----------	----------
1924	492	63,960	1956	417	114,258
1925	429	65,208	1957	837	194,184
1926	1,838	275,700	1958	1,258	256,632
1927	860	110,080	1959	673	154,790
1928	92	11,224			
1929–31	----------	----------	Total	33,176	6,903,770
1932	46	2,760			

REVIEW BY COUNTIES

Of the 120 counties in the State, 107 reported mineral production, compared with 104 in 1958. Leading counties were the large coal and petroleum producers, Hopkins, Muhlenberg, Pike, Harlan, Green, Floyd, and Letcher, which supplied 50 percent of the total State value. In addition to the detailed county production listed in table 10, natural gas, natural-gas liquids, and a small quantity of gem stones (fluorite) of undetermined county origin were produced.

Adair.—Shamrock Stone Co. Inc. crushed limestone for concrete, roads, and agstone at the Butler quarry. A small quantity of crude petroleum was reported.

Allen.—McClellan Stone Co. crushed limestone for concrete, roads, and railroad ballast at the Scottsville quarry. Production of crude petroleum increased 21 percent.

TABLE 10.—Value of mineral production in Kentucky, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value[2]
Adair	$234, 156	(3)	Limestone, petroleum.
Allen	(3)	(3)	Petroleum, limestone.
Anderson	144, 521	(3)	Limestone.
Ballard	18, 340	$14, 970	Sand and gravel.
Barren	282, 483	320, 999	Limestone, petroleum.
Bath	15, 939	15, 785	Petroleum.
Bell	4, 490, 038	4, 371, 487	Coal, sandstone, petroleum.
Boone	(3)	(3)	Sand and gravel.
Bourbon	134, 380	(3)	Limestone.
Boyd	(3)	574, 034	Coal, miscellaneous clay, petroleum.
Boyle	230, 166	565, 192	Limestone.
Breathitt	5, 182, 732	4, 963, 817	Coal, petroleum.
Breckinridge	(3)	(3)	Limestone, petroleum, miscellaneous clay.
Bullitt	(3)	(3)	Miscellaneous clay.
Butler	1, 571, 343	2, 201, 254	Petroleum, coal, limestone.
Caldwell	(3)	(3)	Limestone, coal, fluorspar.
Calloway	11, 400	54, 742	Sand and gravel.
Carlisle	20, 350	12, 700	Do.
Carroll	(3)	(3)	Do.
Carter	2, 451, 791	1, 457, 377	Fire clay, limestone, coal.
Casey	(3)	(3)	Limestone.
Christian	(3)	(3)	Petroleum, limestone, coal.
Clark	(3)	(3)	Limestone.
Clay	4, 305, 186	4, 219, 978	Coal.
Clinton	402, 565	(3)	Petroleum, limestone, coal.
Crittenden	(3)	(3)	Limestone, barite, fluorspar, petroleum, gem stones.
Cumberland	55, 905	92, 642	Petroleum.
Daviess	8, 266, 885	7, 895, 421	Petroleum, coal, sand and gravel, miscellaneous clay.
Edmonson	(3)	(3)	Limestone, petroleum.
Elliott	442, 326	375, 338	Petroleum, coal.
Estill	(3)	412, 286	Petroleum, limestone.
Fayette	756, 203	1, 037, 063	Limestone.
Fleming	(3)	(3)	Do.
Floyd	(3)	(3)	Coal, petroleum, sand and gravel.
Franklin	533, 090	889, 601	Limestone.
Fulton	(3)	(3)	Sand and gravel.
Gallatin	(3)	(3)	Do.
Garrard	----------	(3)	Limestone.
Graves	1, 386, 782	1, 577, 045	Ball clay, sand and gravel.
Grayson	(3)	(3)	Limestone, petroleum.
Green	(3)	22, 424, 067	Petroleum.
Greenup	(3)	(3)	Fire clay, coal, petroleum.
Hancock	1, 375, 197	1, 373. 902	Petroleum, miscellaneous clay, coal.
Hardin	1, 177, 518	1, 226, 164	Limestone, petroleum.
Harlan	(3)	(3)	Coal, limestone.
Harrison	(3)	(3)	Limestone.
Hart	244, 650	202, 585	Limestone, petroleum.
Henderson	(3)	(3)	Petroleum, sand and gravel, coal.
Henry	----------	130	Gem stones.
Hickman	32, 837	27, 200	Sand and gravel.
Hopkins	43, 321, 888	42, 049, 303	Coal, petroleum.
Jackson	(3)	(3)	Coal, limestone, petroleum.
Jefferson	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Jessamine	108, 239	(3)	Limestone.
Johnson	1, 687, 020	1, 455, 817	Coal, petroleum.
Kenton	16, 644	16, 372	Limestone.
Knott	4, 796, 436	3, 496, 111	Coal, petroleum.
Knox	747, 972	353, 512	Do.
Laurel	1, 026, 014	1, 364, 529	Do.
Lawrence	847, 279	1, 001, 792	Petroleum, coal.
Lee	(3)	(3)	Petroleum, limestone, coal.
Leslie	10, 916, 363	12, 051, 780	Coal, petroleum.
Letcher	(3)	(3)	Coal, limestone, petroleum.
Lincoln	5, 272	317, 124	Limestone, petroleum.
Livingston	(3)	(3)	Limestone, fluorspar, zinc, lead, sandstone, sand and gravel, silver, gem stones.
Logan	252, 849	(3)	Limestone, sandstone, petroleum.
Lyon	1, 827	9, 450	Sand and gravel.
Madison	101, 439	(3)	Limestone.
Magoffin	5, 002, 689	4, 468, 218	Petroleum, coal.
Marion	204, 500	(3)	Limestone.
Marshall	14, 319	21, 200	Sand and gravel.
Martin	235, 621	251, 642	Coal, petroleum.
Mason	84, 170	112, 416	Sand and gravel.
McCracken	(3)	558, 000	Do.
McCreary	1, 895, 271	2, 129, 026	Coal, petroleum, sandstone.
McLean	2, 858, 954	2, 156, 063	Petroleum, coal.
Meade	(3)	(3)	Limestone.
Menifee	212, 676	271, 707	Limestone, petroleum.

See footnotes at end of table.

TABLE 10.—Value of mineral production in Kentucky, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value [2]
Mercer	$299,011	$168,636	Limestone.
Metcalfe	(3)	(3)	Petroleum, limestone.
Monroe	(3)	(3)	Limestone, petroleum.
Montgomery	----------	818	Petroleum.
Morgan	(3)	(3)	Coal, limestone, petroleum.
Muhlenberg	(3)	35,268,839	Coal, petroleum, limestone.
Nelson	(3)	(3)	Limestone.
Nicholas	(3)	28,630	Do.
Ohio	(3)	(3)	Coal, petroleum, limestone.
Oldham	(3)	(3)	Limestone.
Owsley	10,350	156,079	Coal, petroleum.
Pendleton	(3)	(3)	Limestone.
Perry	21,998,950	18,858,574	Coal, petroleum.
Pike	(3)	(3)	Coal, petroleum, limestone, sand and gravel.
Powell	408,111	(3)	Petroleum, limestone, miscellaneosu clay.
Pulaski	(3)	(3)	Coal, limestone.
Rockcastle	680,034	(3)	Limestone, coal.
Rowan	(3)	350,701	Limestone, fire clay, miscellaneous clay.
Russell	575	22,045	Petroleum.
Simpson	(3)	239,826	Limestone, petroleum.
Taylor	817	3,167,426	Petroleum.
Todd	(3)	(3)	Limestone, petroleum.
Trigg	68,000	34,125	Limestone.
Union	14,008,326	15,864,132	Coal, petroleum, sand and gravel, miscellaneous clay.
Warren	683,519	714,671	Limestone, petroleum.
Wayne	384,978	(3)	Limestone, petroleum, coal.
Webster	8,178,665	6,992,259	Coal, petroleum.
Whitley	(3)	(3)	Coal, miscellaneous clay, petroleum.
Wolfe	227,585	205,980	Petroleum, coal.
Undistributed	247,067,854	205,928,413	
Total	402,121,000	416,391,000	

[1] County figures exclude natural gas and natural-gas liquids, included with "Undistributed". The following counties did not report production: Bracken, Campbell, Grant, Larue, Lewis, Owen, Robertson, Scott, Shelby, Spencer, Trimble, Washington, and Woodford.

[2] Other than natural gas and natural-gas liquids.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Anderson.—Kentucky Stone Co. (Tyrone mine) crushed limestone for concrete, roads, agstone, and railroad ballast.

Ballard.—Kentucky State Highway Department mined 20,000 tons of paving gravel.

Barren.—J. F. Pace Construction Co. crushed 138,000 tons of limestone for concrete and roads. Production of crude petroleum decreased 25 percent.

Bath.—Production of crude petroleum increased 1 percent.

Bell.—Fifty-nine mines produced coal; leading producers were Crockett mine (Kentucky Ridge Coal Co.), No. 1 Strip mine (Atlas Mining Co. Inc.), and Southern Star mine (Red Star, Inc.). Levi Polly crushed sandstone for concrete and roads at Pine Mountain quarry. Production of crude petroleum increased 66 percent.

Boone.—Standard Materials Co. (Belleview mine) and Kentucky Sand Co. (Taylorsport mine) mined sand and gravel for building, paving, and fill uses.

Bourbon.—Bourbon Limestone Co. Inc. (Snapp quarry) and Hinkle Construction Corp. (Farmers quarry) crushed limestone for concrete, roads, and agstone.

Boyd.—Eight coal mines were active; leading producers were No. 2A mine (Flo Glo Coal Co.), and Coalton Strip and Coalton Auger mines (Charles E. Yates). Big Run Coal & Clay Co. Inc. (Princess mine) mined miscellaneous clay for heavy clay products. Production of crude petroleum decreased 12 percent.

Boyle.—Caldwell Stone Co. Inc. (Danville quarry) and Boyle County Highway Department (Perryville quarry) crushed 439,000 tons of limestone for concrete, roads, and agstone.

Breathitt.—Fourteen coal mines were active; leading producers were No. 3 Elkhorn mine (Island Creek Coal Co.), No. 6 mine (Vires Coal Co.), and No. 1 mine (Six Mile Coal Co.). Crude petroleum production increased 59 percent.

Breckinridge.—Kentucky Stone Co. (Webster quarry) and White Stone Co. (Hardinsburg quarry) crushed limestone for concrete, roads, railroad ballast, and agstone. Murray Tile Co. Inc. (Cloverport mine) mined miscellaneous clay for heavy clay products. Crude petroleum production decreased 55 percent.

Bullitt.—Kenlite Division of Kentucky Light Aggregates, Inc. (Shepherdsville mine) mined miscellaneous clay for producing lightweight aggregate.

Butler.—Six coal mines were active; leading producers were South Hill Strip mine (Butler Coal, Inc.), Green River No. 2 mine (M. R. Melton Coal Co.), and Skoog & Stuart mine (Skoog & Stuart Coal Co.). Gary Bros. Crushed Stone Co. (Morgantown quarry) crushed limestone for concrete and roads. Crude petroleum production increased 66 percent.

Caldwell.—Cedar Bluff Stone Co. (Cedar Bluff mine) and Fredonia Valley Quarries, Inc. (Fredonia quarry) produced limestone for riprap, concrete, roads, and agstone. Caldwell County Strip mine (Watson Bridge Mining Co.) was the only active coal mine. James H. Cravens mined a small quantity of fluorspar.

Calloway.—Murray Sand Co. Inc. and the State highway department mined 44,000 tons of structural, glass, molding, and other industrial sands and paving gravel.

Carlisle.—State highway department mined paving gravel.

Carroll.—Standard Materials Co. (Milton mine) and Carrollton Gravel-Sand Co. Inc. (Carrollton mine) mined structural and paving sand and gravel.

Carter.—Eighteen mines produced 164,000 tons of fire clay for firebrick and block, fire-clay mortar, and heavy clay products. The leading producers were Brinegar Strip and Stinson mines (Harbison-Walker Refractories Co.) and Olive Hill mine (General Refractories Co.). Acme Stone Co. Inc., Standard Slag Co., and Carter County Stone Co. crushed limestone for concrete and roads. Four coal mines were active; leading producer was Grayson Block mine (Fields Branch Coal Co.).

Casey.—Casey Stone Co. produced limestone for riprap, concrete, roads, and agstone at Bethel Ridge mine.

Christian.—Hopkinsville Stone Co. Inc., Christian Quarries, Inc., and Harry Berry, Inc. (Fort Campbell quarry) crushed limestone for concrete, roads, and agstone. No. 6 Strip mine (Boonville Coal Sales Corp.) and No. 1 Strip mine (Cecil Hopper Coal Co.) were the only active coal mines. Crude petroleum production increased 27 percent.

Clark.—The Allen Co. crushed limestone for concrete, roads, and agstone at Boonesboro mine.

Clay.—Sixty-two mines produced 1,023,000 tons of coal; leading producers were No. 4 mine (Hacker Coal Co.), No. 1 Strip mine (Keith & Peters Coal Co.), and Hornsby No. 3 mine (Eagle Branch Coal Co.).

Clinton.—Shamrock Stone Co. (Caldwell quarry) crushed limestone for concrete, roads, and agstone. Four coal mines were active; leading producers were Gwinn mine (O. D. Gwinn Coal Co.) and No. 1 mine (Cross Bros. Coal Co.). Crude petroleum production increased 27 percent.

Crittenden.—Alexander Stone Co. (No. 1 quarry) produced limestone for riprap, concrete, roads, and agstone. The leading producer of fluorspar was Craighead & Coates (Stallions mine). Kentucky Fluorspar Co., Roberts & Frazier, and three other brokers purchased fluorspar from local and foreign producers for shipment to a variety of consumers. J. Willis Crider Fluorspar Co. (Pigmy mine) and Mico Mining & Milling Co. (Cook mine) mined barite for the first time since 1943. Calvert City Chemical Co. operated its flotation mill at Mexico, treating fluorspar from its Dyer's Hill mine in Livingston County. Majors Rocks collected a small quantity of gem stones (fluorite). Production of crude petroleum decreased 7 percent.

Cumberland.—Production of crude petroleum increased 69 percent.

Daviess.—Five coal mines were active; leading producers were K–9 Strip mine (Green Coal Co.) and Morris Strip mine (Morris Enterprises). Owensboro River Sand & Gravel Co. (Owensboro mine) and Daviess County Sand & Gravel Co. (Daviess mine) mined 231,000 tons of sand and gravel for structural, paving, engine, and fill uses. Joseph L. Clark Tile Co. (Moselyville mine) mined miscellaneous clay for heavy clay products. Crude petroleum production decreased 1 percent.

Edmonson.—McClellan Stone Co. (No. 4 quarry) crushed limestone for concrete, roads, and agstone. A small quantity of crude petroleum was produced.

Elliott.—No. 2 mine (Copley Coal Co.) and No. 3 mine (Ralph Hartman Coal Co.) were the only active coal mines. Production of crude petroleum decreased 13 percent.

Estill.—Estill County Stone Co. Inc. crushed 50,000 tons of limestone for concrete and roads. Production of crude petroleum decreased 7 percent.

Fayette.—Central Rock Co. (Lexington mine) and Blue Grass Stone Co. (Lexington quarry) crushed 704,000 tons of limestone for concrete, roads, and agstone.

Fleming.—Gorman Construction Co. (Carpenter quarry) crushed limestone for concrete, roads, and agstone.

Floyd.—Floyd County ranked sixth in the State in total value of mineral production. There were 258 active coal mines; leading producers were Wheelwright mine (Inland Steel Co.) and No. 2 and Open Fork mines (Princess Elkhorn Coal Co.). Mare Creek Sand Co. Inc. (Allen mine) mined structural and engine sand. Production of crude petroleum decreased 6 percent.

Franklin.—Blanton Stone Co. Inc. (Frankfort mine), Franklin County Stone Co. (Frankfort quarry), and Frankfort Builders

Supply Co. Inc. (Devil's Hollow mine) crushed limestone for concrete, roads, railroad ballast, and agstone.

Fulton.—Hickman Sand & Gravel Co. and the State highway department mined paving sand and gravel.

Gallatin.—C & H Gravel Co. Inc. (Sam Hill mine) and Gallatin Sand & Gravel Co. (Warsaw mine) mined structural, paving, fill, and miscellaneous sand and structural, paving, and fill gravel.

Garrard.—Camp Nelson Stone Co. crushed limestone for concrete and roads at the Edwards quarry.

Graves.—Five mines produced 112,000 tons of ball clay for use in whiteware, art pottery, high-grade tile, kiln furniture, firebrick and block, enameling, and other uses. The leading producer was Kentucky-Tennessee Clay Co. The State highway department mined 79,000 tons of paving gravel.

Grayson.—Ragland Bros. (Leitchfield quarry) and Rogers & Brunnhoeffer crushed limestone for concrete, roads, and railroad ballast. A small quantity of crude petroleum was produced.

Green.—Green County ranked fifth in the State in total value of mineral production. Production of crude petroleum increased substantially over the amount reported for 1958.

Greenup.—Six mines produced fire clay for firebrick and block; leading producers were M. A. McCoy (Greenup Strip mine) and Harbison-Walker Refractories Co. (Riggs mine). Four coal mines were active; leading producer was No. 1 mine (Spencer Sweeney Coal Co.). Production of crude petroleum decreased 44 percent.

Hancock.—Six mines produced 162,000 tons of miscellaneous clay for heavy clay products; leading producer was Cannelton Sewer Pipe Co. Hawesville strip mine (Charbon Stripping Co.) was the only active coal mine. Crude petroleum production decreased 8 percent.

Hardin.—Kentucky Stone Co. (Upton quarry and Lilmay mine), Osborne Bros., and Waters Construction Co. produced limestone for riprap, concrete, roads, agstone, asphalt filler, and other uses. A small quantity of crude petroleum was produced.

Harlan.—Harlan County ranked fourth in the State in total value of mineral production. There were 141 active coal mines; leading producers were No. 32 mine (United States Steel Corp.), No. 2 mine (International Harvester Co.), and Harlan No. 4 mine (Alva Coal Corp.). Sam Nally Co. crushed limestone for concrete and roads.

Harrison.—Genet Stone Co. Inc. crushed limestone for concrete, roads, and agstone at Cynthiana quarry.

Hart.—McLellan Stone Co. crushed limestone for concrete, roads, and agstone at Horse Cave quarry. Production of crude petroleum decreased 25 percent.

Henderson.—Bedford-Nugent Co. Inc. mined sand and gravel for structural, paving, and fill uses. There were seven active coal mines; leading producers were Mike & Pat mine (Dolph Hazelwood Coal Co.), Community mine (Community Coal Co.), and No. 1 Henderson mine (Henderson Mining Co. Inc.). Production of crude petroleum increased 32 percent.

Henry.—Majors Rocks collected a small quantity of miscellaneous gem stones.

Hickman.—State highway department mined 36,000 tons of paving gravel.

Hopkins.—Hopkins County led the State in total value of mineral production. Thirty-nine coal mines were active; leading producers were Pleasant View and East Diamond mines (West Kentucky Coal Co.), White City Strip mine (Peabody Coal Co.), and Fies mine (Nashville Coal, Inc.). Crude petroleum production decreased 33 percent.

Jackson.—Fifteen coal mines were active; leading producers were Travis Creek mine (Marcum Coal Co. Inc.), No. 1 mine (Rose Bros. Coal Co.), and Blythe Branch No. 2 mine (Sturgill Coal Co.). M. A. Walker & Co. crushed limestone for concrete, roads, and agstone at Indian Creek and Clover Bottom mines. Crude petroleum production decreased 41 percent.

Jefferson.—Kosmos Portland Cement Co. produced masonry and portland cements at Kosmosdale mill. Limestone was crushed at five quarries and one mine for concrete, roads, railroad ballast, and agstone; leading producers were Louisville Crushed Stone Co. (Louisville mine) and Falls City Stone Co. (Fern Creek quarry). Six mines produced structural, paving, fill, and other sand and gravel; the leading producers were Ohio River Sand Co. Inc., and E. T. Slider Co. Inc. Kosmos Portland Cement Co. (Kosmosdale mine) and General Shale Products Co. (Coral Ridge mine) mined miscellaneous clay for cement and heavy clay products.

Jessamine.—Kentucky Stone Co. (High Bridge mine) crushed limestone for concrete, roads, railroad ballast, and agstone.

Johnson.—Sixty coal mines were active; leading producers were No. 8 mine (Whitten Coal Co.), Hager Hill mine (Lynn Mining Co.), and No. 1 mine (Walker Gap Choice Coal Co.). Production of crude petroleum decreased 18 percent.

Kenton.—Franxman Bros. crushed limestone for concrete and roads at the Covington quarry.

Knott.—Leading producers of the 148 active coal mines were No. 1 mine (Flax Coal Co.), No. 1 mine (Leatherwood Mining Co.), and No. 2 mine (Logan Gap Coal Co.). Production of crude petroleum decreased 20 percent.

Knox.—Leading producers of the 35 active coal mines were No. 1 mine (J & R Coal Co.), Bull Creek No. 4 mine (New White Coal Co.), and No. 1 Strip mine (Hub Coal Co.). Crude petroleum production decreased 26 percent.

Laurel.—There were 13 active coal mines; leading producers were No. 1 Strip mine (Laurel Mountain Coal Co. Inc.), No. 2 mine (Bubby Coal Co.), and No. 1 Strip mine (B G & M Coal Co.). Crude petroleum production increased 9 percent.

Lawrence.—Six coal mines were active; leading producers were No. 1 mine (Arlie Hall Coal Co.) and No. 7 mine (Hammonds Fork Coal Co.). Crude petroleum production increased 36 percent.

Lee.—Six coal mines were active; leading producers were Pacemaker mine (Congleton Bros. Inc.), and No. 1 mine (Little Gem Coal Co.). Kentucky Stone Co. (Yellow Rock mine) and Central Engineering Co. (Old Landing quarry) crushed limestone for concrete, roads, railroad ballast, and agstone. Crude petroleum production increased 3 percent.

Leslie.—There were 64 active coal mines; leading producers were Deby No. 2 mine (Deby Coal Co.), No. 8 mine (Shamrock Coal Co.), and No. 7 mine (Mary Gail Coal Co.). Crude petroleum production increased 11 percent.

Letcher.—Letcher County ranked seventh in the State in total value of mineral production. There were 207 active coal mines; leading producers were No. 22 mine (Bethlehem Mines Corp.), and Big Chief and La Viers No. 2 mines (South East Coal Co.). Hurricane Gap Quarries, Inc. crushed limestone for concrete and roads. Production of crude petroleum increased substantially over the amount reported for 1958.

Lincoln.—Lovell & Hart, Inc. crushed limestone for concrete and roads. Production of crude petroleum increased substantially over the amount reported for 1958.

Livingston.—Reed Crushed Stone Co. Inc. (Grand Rivers quarry) and West Tennessee Limestone Co. (Barrett's quarry) produced limestone for riprap, concrete, roads, and agstone. Calvert City Chemical Co. (Dyer's Hill mine), Atwood Mining Co. (Atwood mine), and Tinsley & Loyd (Nancy Hanks mine) mined fluorspar for metallurgical uses and for hydrofluoric acid for chemicals. State highway department mined paving gravel. Salem Building Stone Co. (Burna quarry) quarried dimension sandstone for rough architectural use. Small quantities of zinc, lead, and silver were recovered from the milling of fluorspar. A. Gilland and T. Harnice collected a small quantity of gem stones (fluorspar).

Logan.—Kentucky Stone Co. (Russellville mine) crushed limestone for concrete, roads, railroad ballast, and agstone. Kentucky Flagstone Co. (Lewisburg quarry) and Kentucky Kolor Stone Corp. (Russellville quarry) quarried dimension sandstone for rough architectural use and for flagging. Crude petroleum production decreased 32 percent.

Lyon.—State highway department mined paving gravel.

Madison.—Kentucky Stone Co. crushed limestone for concrete, roads, and agstone at Boonesboro mine.

Magoffin.—Seventeen coal mines were active; leading producers were No. 2 mine (Hogtown Coal Co.), No. 1 Strip mine (R. W. Howard Coal Co.), and No. 1 Strip mine (Tip Top Coal Co.). Crude petroleum production decreased 14 percent.

Marion.—Ward & Montgomery (Lebanon quarry) and Lebanon Stone Co. crushed limestone for concrete, roads, and agstone.

Marshall.—State highway department mined paving gravel.

Martin.—Four coal mines were active; leading producer was No. 2 mine (Webbs Coal & Mining Co.). Crude petroleum production decreased 9 percent.

Mason.—J. F. Hardymon Co. mined structural, paving, and fill sand and gravel.

McCracken.—Federal Materials Co. Inc. and McCracken County Highway Department mined structural and paving sand and gravel.

McCreary.—Twenty-one coal mines were active; leading producers were Nos. 18 and 16 mines (Stearns Coal & Lumber Co.) and Holly Hill Strip mine (B. R. Campbell & Son Coal Co. Inc.). Thomas C. Mayne quarried dimension sandstone at the Day Ridge quarry for rubble and flagging. Crude petroleum production decreased 21 percent.

McLean.—The only active coal mine was Jarvis Strip mine (W. H. Jarvis Coal Co.). Production of crude petroleum decreased 23 percent.

Meade.—Kosmos Portland Cement Co. (Hartford quarry) and Owensboro River Sand & Gravel Co. (Riverside mine) crushed limestone for cement, concrete, roads, and agstone.

Menifee.—A. W. Walker & Son crushed limestone for concrete, roads, and agstone at the Frenchburg quarry. Production of crude petroleum increased substantially over the amount reported for 1958.

Mercer.—Mercer Stone Co. and Mercer County Highway Department crushed limestone for concrete, roads, and agstone.

Metcalfe.—Montgomery & Co. crushed limestone for concrete, roads, and agstone at Chapman quarry. Production of crude petroleum increased substantially over 1958.

Monroe.—Trico Stone, Inc. (Monroe quarry) crushed limestone for concrete, roads, and agstone. Crude petroleum increased 49 percent.

Montgomery.—A small quantity of crude petroleum was reported.

Morgan.—Ten coal mines were active; leading producers were No. 1 Strip mine (Marshall & Sheets Coal Co.), No. 9 mine (Mack Marsillett Coal Co.), and No. 1 Strip mine (Andrew Reed Coal Co.). Kentucky Road Oiling Co. (Wrigley quarry) and Licking River Limestone Co. (Zag quarry) crushed limestone for concrete, roads, agstone, and other uses. Production of crude petroleum decreased 3 percent.

Muhlenberg.—Muhlenberg County ranked second in the State in total value of mineral production. Twenty-six coal mines were active; leading producers were River Queen Strip mine (River Queen Coal Co.), Vogue Strip mine (Peabody Coal Co.), Gibraltar Strip mine (Gibraltar Coal Corp.), and Paradise Strip mine (Pittsburgh & Midway Coal Mining Co.). Greenville Quarries, Inc., crushed limestone for concrete, roads, and agstone. Production of crude petroleum decreased 10 percent.

Nelson.—Geoghegan & Mathis crushed limestone for concrete, roads, and agstone at Nelson quarry.

Nicholas.—Nicholas County Highway Department crushed limestone for concrete and roads at the county quarry.

Ohio.—Eighteen coal mines were active; leading producers were Ken Strip mine (Peabody Coal Co.), No. 1 Strip mine (Riverview Coal Co.), and R. N. Robards Strip mine (R. N. Robards Coal Co.). State Contracting & Stone Co. (Hartford quarry) and Fort Hartford Stone Co. (Hartford mine) produced limestone for riprap, concrete, roads, railroad ballast, and agstone. Production of crude petroleum decreased 7 percent.

Oldham.—W. T. Liter (Crestwood mine) and Joe Clark Stone Co. (Clark quarry) crushed limestone for concrete, roads, and agstone.

Owsley.—Early Bird Strip mine (The Wilmuth Corp.) and No. 31 Strip mine (Kentucky River Collieries) were the only active coal mines. Production of crude petroleum decreased 33 percent.

Pendleton.—Geoghegan & Mathis crushed limestone for concrete, roads, and agstone at the Butler and Falmouth quarries.

Perry.—Leading producers of the 103 active coal mines were Leatherwood Nos. 1 and 2 mines (Blue Diamond Coal Co.) and Blair Fork mine (Jewel Ridge Coal Corp.). Production of crude petroleum increased 21 percent.

Pike.—Pike County ranked third in the State in total value of mineral production. There were 269 active coal mines; leading producers were Stone mine (Eastern Coal Corp.), No. 20 mine (Bethlehem Mines, Corp.), Kentland No. 1 mine (Kentland Elkhorn Coal Co.), and Republic mine (Republic Steel Corp.). Johnson Bros. Limestone Co. crushed limestone for concrete and roads. Pike Sand Co. mined structural sand at the Walters mine. Production of crude petroleum decreased 12 percent.

Powell.—A. W. Walker & Son crushed limestone for concrete, roads, and agstone at the Whiterock quarry. Big Run Coal Co. and H. B. Sipple Brick Co. (Faulkner No. 1 mine) mined miscellaneous clay for heavy clay products. Production of crude petroleum increased 35 percent.

Pulaski.—Leading producers of the 11 active coal mines were No. 3 Strip mine (Ikerd & Bandy Coal Co. Inc.) and Wildcat No. 2 mine (Foster Stokes Coal Co.). Strunk Construction Co. (Tateville quarry and Somerset Stone Co. Inc., crushed limestone for concrete, roads, and agstone.

Rockcastle.—Kentucky Stone Co. crushed limestone for concrete, roads, railroad ballast, and agstone at the Mullins and Mount Vernon mines. There were 11 active coal mines; leading producers were No. 1 mine (Black Foot Coal Co.), No. 3 Strip mine (Fuson Coal Co.), and Brush Creek Strip mine (Callihan & Callihan Coal Co.).

Rowan.—Morehead Limestone Co. crushed limestone for fluxing stone, concrete, roads, and agstone. Four mines produced fire clay for firebricks and block and fire-clay mortar; leading producer was the Johnson mine (General Refractories Co.). Lee Clay Products Co. Inc. (Lee Clay mine) mined miscellaneous clay for heavy clay products.

Russell.—Production of crude petroleum increased substantially over the amount reported for 1958.

Simpson.—Southern Stone Co. Inc. (Franklin quarry) crushed limestone for concrete, roads, and agstone. Crude petroleum production increased 58 percent.

Taylor.—Production of crude petroleum increased substantially over the amount reported for 1958.

Todd.—Kentucky Stone Co. (Todd quarry) and D. W. Dickinson & Son (Gallatin quarry) crushed limestone for concrete, roads, and agstone. Crude petroleum production decreased 15 percent.

Trigg.—Cedar Bluff Stone Co. Inc. crushed limestone for concrete, roads, and agstone at the Cerulean quarry.

Union.—The three active coal mines were Uniontown mine (Nashville Coal Co. Inc.), Dekoven mine (P & M Coal Mining Co.), and No. 1 Strip mine (P & S Coal Co.). Union Sand & Gravel Co. (Morganfield mine) mined structural and paving sand and gravel. Clarks Clay Products Co. (Uniontown mine) mined miscellaneous clay for heavy clay products. Production of crude petroleum decreased 4 percent.

Warren.—McLellan Stone Co. (Warren and Smith's Grove quarries), White Stone Quarry, and Gary Bros. Crushed Stone Co. produced limestone for riprap, concrete, roads, agstone, and stone sand. Crude petroleum production decreased 5 percent.

Wayne.—Bassett Products Co. (Bassett quarry) crushed limestone for concrete, roads, and agstone. The No. 1 mine (Thomas Jones Coal Co.) and No. 1 mine (Harvey Worley Coal Co.) were the only active coal mines. Production of crude petroluem increased 41 percent.

Webster.—Six coal mines were active; leading producers were Precision Washed Strip mine (Hart & Hart Coal Co.) and Choctaw Strip mine (Russell Badgett Coal Co.). Crude petroleum production decreased 10 percent.

Whitley.—Forty-six coal mines were active; leading producers were No. 3 mine (Reaves Dixie Gem Coal Co.), No. 1 Auger mine (Red Bird Mining Co. Inc.), and Whitley Strip mine (Whitley Strip Mining Co. Inc.). Corbin Brick Co. mined miscellaneous clay for heavy clay products. A small quantity of crude petroleum was produced.

Wolfe.—Miller mine (C. L. Thompson Coal Co.), No. 1 mine (Perry Coal Co.), and Red River Strip mine (Red River Block Coal Co.) were the only active coal mines. Crude petroleum production decreased 21 percent.

The Mineral Industry of Louisiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Louisiana Geological Survey.

By Robert S. Sanford[1] and Leo W. Hough[2]

◆

LOUISIANA ranked second among the States in the value of its mineral production for the second consecutive year. To keep pace with the accelerated industrial development in the State, new records were made in production of crude petroleum, natural gas, natural-gas liquids, sulfur, salt, sand and gravel, portland cement, stone, and clays (in order of value).

Louisiana's mineral industry was dominated by crude petroleum, natural gas, and natural-gas liquids, which furnished over 92 percent of the total value of mineral output. Proved recoverable reserves of these liquid hydrocarbons reached new highs, despite increased production. Louisiana's share of the Nation's increased reserves of these commodities in 1959 was 52 percent for petroleum and natural-gas liquids and 56 percent for natural gas.

TABLE 1.—Mineral production in Louisiana[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clay[2]	755	$755	904	$904
Natural gas ... million cubic feet	2,451,587	316,255	[3] 2,480,400	[3] 324,900
Natural-gas liquids:				
Natural gasoline and cycle products ... thousand gallons	783,099	50,371	846,110	60,295
LP-gases ... do	410,869	21,435	540,046	25,877
Petroleum (crude) . thousand 42-gallon barrels	313,891	1,023,517	[3] 354,611	[3] 1,120,115
Salt (common)	3,442	18,960	4,807	20,918
Sand and gravel	15,061	17,119	16,052	20,111
Stone	5,453	9,532	5,670	10,874
Sulfur (Frasch-process) ... thousand long tons	2,028	47,651	2,252	52,779
Value of items that cannot be disclosed: Cement, bentonite, gypsum, and lime	------------	20,475	------------	20,286
Total Louisiana[4]	------------	[5] 1,523,370	------------	1,654,493

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite, value for which is included with "Items that cannot be disclosed."
[3] Preliminary figure.
[4] Total value has been adjusted to avoid duplicating clays used for cement and oystershell used in producing lime and cement.
[5] Revised figure.

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At the end of 1959, construction of a ½-mile steel platform by Freeport Sulphur Co. for the first offshore sulfur mine was nearing completion. Construction of Freeport Nickel Co.'s nickel refinery was completed. The first 5 miles of the 77-mile, $100 million, new Mississippi River-Gulf outlet channel was completed to full project dimensions (36 feet in depth over a bottom width of 500 feet). Dredging was continued. Construction of new plants and additions to existing petrochemical plants, natural gasoline plants, and petroleum refineries continued throughout the year.

The Mississippi River is one of the greatest industrial attractions in the Baton Rouge-New Orleans area. The river is the Nation's largest fresh-water supply, with an average flow of more than 300 billion gallons of water a day. Several industries in the area use more water a day than cities the size of Cincinnati, Ohio. The river is navigable the entire year for large oceangoing vessels as far as Baton Rouge and provides cheap barge transportation up the Mississippi, Ohio, Illinois, and Missouri Rivers.

In 1959 construction was started on the Port of New Orleans Bulk Unloading Facility on the new Mississippi River-Gulf Outlet. To keep pace with industrial expansion, several Louisiana power and light

TABLE 2.—Employment and wages in the mineral industries[1]

Activity	Average number of workers		Total wages and salaries (thousands)	
	1958	1959	1958	1959
Production of crude petroleum, natural gas, and natural-gas liquids	20,380	19,830	$132,731	$135,543
Oil- and gas-field contract services	[2] 20,673	21,770	[2] 108,021	118,214
Sand and gravel quarries, pits, and dredges	1,343	1,390	4,803	5,103
Salt mines	714	786	3,308	3,509
Nonmetallic minerals	[3] 1,735	1,611	[3] 10,092	10,473
Total	44,845	45,387	258,955	272,842

[1] Louisiana State Department of Labor, Division of Employment Security.
[2] Includes approximately 3,300 formerly in service industries. The additional item is geophysical services.
[3] Mainly sulfur; does not include shell production workers in 1958.

TABLE 3.—Total wage and salaried workers in petroleum production, refining, and related industries[1]

Year	Crude petroleum and natural gas production	Petroleum refining[2]	Pipeline transportation (except natural gas)	Gas utilities	Petroleum bulk-tank stations	Retail filling stations	Chemicals manufactured as byproducts of petroleum or used in the refining of petroleum[3]	Total
1950-54 (average)	27,040	16,160	1,440	4,620	3,370	5,670	9,080	67,380
1955	35,900	15,800	1,450	5,100	3,900	7,400	11,350	80,900
1956	40,200	15,500	1,400	5,600	4,400	8,400	12,050	87,550
1957[4]	42,300	15,700	1,500	5,800	4,700	8,400	12,350	90,750
1958[4]	[5] 41,350	15,450	1,400	6,000	4,600	8,600	13,050	90,450
1959[6]	[5] 42,000	13,400	1,300	6,300	4,450	9,000	12,300	88,750

[1] Louisiana State Department of Labor, Division of Employment Security.
[2] Employment in petrochemical manufacturing facilities located in petroleum refineries.
[3] Employment in petrochemical manufacturing facilities located outside petroleum refineries.
[4] Revised figures.
[5] Includes 3,300 formerly in service industries.
[6] Preliminary figures.

companies were building new steam-electric generating stations and were adding new generating units to existing stations.

Employment and Injuries.—Employment in Louisiana's important petroleum industry in 1959 totaled 88,750 workers. Weekly earnings per employee averaged over $111. According to records of the Louisiana Division of Employment Security, the petroleum industry employs 15.7 percent of the covered employment in the State and pays 22.4 percent of the wages. In manufacturing, petroleum refining and petrochemicals represent 20.1 percent of the covered employment and pay 28.8 percent of the wages.

As vast quantities of petrochemicals are manufactured in petroleum refineries, it is impossible to segregate the employees in chemical units from those in refinery operations. Consequently, it is difficult to isolate data on the growth of the petrochemical industry, except for plants that are separate and distinct from the refineries.

In all nonmetal mining and processing operations there were 2 fatal, 3 permanent-partial, and 130 temporary injuries. In the alumina and aluminum refining plants there were 3 permanent-partial and 35 temporary injuries. The injury statistics are incomplete for the petroleum industry. An explosion and flash fire on a spud barge offshore in Timbalier Bay on August 1 resulted in one death. Two were missing and presumed dead and five hospitalized. The company was drilling at 8,500 feet when gas sand was encountered and the well started spewing gas, salt water, and mud. The drilling barge broke in half; later, an explosion set the escaping gas afire.

TABLE 4.—Value of construction contracts awarded, in thousands [1]

Type	1956	1957	1958	1959	Percent change from 1958
Residential [2]	$189, 241	$235, 943	$245, 604	$258, 974	+5. 4
Nonresidential [3]	206, 844	205, 035	164, 070	171, 565	+4. 6
Public works and utilities	252, 176	188, 653	268, 513	230, 716	−14. 1
Total	648, 261	629, 631	678, 187	661, 255	−2. 5

[1] Louisiana Business Review, Dodge Statistical Research Service: Vol. 24, No. 2, February 1960, p. 14.
[2] Includes apartments, hotels, and dormitories, and one- and two-family dwellings.
[3] Includes commercial, manufacturing, educational, and other nonresidential buildings.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Louisiana continued to be a leading domestic producer of crude petroleum and natural gas and a major supplier of natural-gas liquids and refined petroleum products. The State held its first offshore leasing of mineral rights in almost 3 years on February 20, 1959, and accepted more than $60 million in bonuses for oil and gas leases on State lands. High bids totaling more than $88 million were accepted August 11, 1959, for land-lease sale of disputed Louisiana offshore oil lands by a joint committee composed of three members of the Louisiana Mineral Board and three members of the Federal Bureau of Land Management. Other bids of more than $2 million were rejected.

Leasing and development of the disputed offshore land had been proceeding under a joint agreement between the State and the U.S. Department of the Interior, with bonus payments, royalties, and rentals being held in escrow. The lease sale was the first held under Federal Government regulations since 1955.

Exploration and Reserves.—The number of holes drilled for petroleum and natural gas was 3,909, a gain of 8 percent over 1958 and only 8 percent less than the record attained in 1955. Statewide drilling of 1,001 exploratory wells (about 126 more than in 1958) proved 28 percent productive (25 percent in 1958) and led to the discovery of 49 oil or natural-gas fields; 15 oil and 6 gas discoveries were in north Louisiana, 11 oil and 13 gas discoveries were in south Louisiana, and 4 gas discoveries were offshore.

Proved recoverable reserves of crude petroleum, natural gas, and natural-gas liquids in Louisiana all reached new records, despite increased production. Much of the increase in reserves came from extensions and revisions of previous estimates of pools and fields discovered before 1959. The State's petroleum reserve increased 616 million barrels (52 percent of the Nation's net increase) to a new record of 4,660 million barrels or 15 percent of the Nation's oil reserves. The natural gas reserve increased 4.7 trillion cubic feet (56 percent of the Nation's net increase) to a new record of 59.9 trillion cubic feet or 23 percent of the Nation's natural gas reserve. The reserve of

TABLE 5.—Production and estimated reserves of crude petroleum in Louisiana offshore area, 1959, and cumulative total[1]

Offshore area	1958	1959			Number of wells	
	Crude petroleum (thousand barrels)	Crude petroleum (thousand barrels)	Cumulative total (thousand barrels)	Estimated reserve (thousand barrels)	1958	1959
Bay Marchand: Block 2[2][3]	8,421	6,093	32,155	67,845	180	199
Belle Isle[3]	822	749	5,110	19,890	38	34
Caillou Island[2]	[4] 10,856	[3] 15,062	[3] 143,156	[3] 74,844	[4] 337	446
Eugene Island:						
Block 18	642	1,223	3,933	21,067	14	31
Block 32	899	1,046	4,992	20,008	24	27
Block 126[2]	3,286	3,396	17,495	107,505	66	70
Block 128	1,669	1,776	4,947	35,053	38	41
Block 188	----------	721	854	9,146	--------	18
Grand Isle:						
Block 16	1,722	2,410	5,336	44,664	47	57
Block 18	1,909	1,818	11,225	27,775	35	32
Block 47	2,128	3,340	6,014	53,986	52	58
Lake Washington[2]	[4] 9,599	[3] 10,902	[3] 51,841	[3] 158,159	[4] 313	343
Main Pass: Block 69[2]	6,917	7,417	38,161	161,839	180	180
Ship Shoal: Block 154	1,524	1,814	4,623	35,377	45	42
South Pass:						
Block 24[2][3]	15,067	16,423	84,704	200,296	469	521
Block 27[2]	3,579	5,620	13,723	96,268	110	147
Timbalier Bay[2][3]	8,558	10,220	44,892	112,108	291	295
South Timbalier: Block 86	----------	381	452	4,548	--------	5
West Cameron: Block 45	----------	530	1,976	13,024	--------	20
West Delta:						
Block 30[2]	4,476	6,314	14,978	115,022	135	173
Block 53[3]	1,032	1,044	4,823	17,177	13	14
Total	83,106	98,299	495,390	1,395,601	2,387	2,753

[1] Oil and Gas Journal, vol. 58, No. 4, Jan. 25, 1960, pp. 164–165.
[2] Estimated ultimate recovery of 100 million barrels or more.
[3] Combined onshore and offshore.
[4] Onshore only.

natural-gas liquids increased 162 million barrels (52 percent of the Nation's net increase) to a new record of 1,358 million barrels or 21 percent of the Nation's reserve. About 30 percent of the crude petroleum reserve was in the offshore area, compared with 27 percent in 1958 and 17 percent in 1957.

TABLE 6.—Production and additions to reserves of crude petroleum, natural gas, and natural-gas liquids [1]

Year	Crude petroleum [2]		Natural gas [3]		Natural-gas liquids [2]	
	Production	Net additions to reserves	Production	Net additions to reserves	Production	Net additions to reserves
1950	209	275	832	1,845	21	47
1951	232	100	1,054	472	22	41
1952	244	273	1,237	2,447	23	29
1953	257	202	1,294	3,007	23	100
1954	247	202	1,399	2,341	23	71
1955	271	294	1,680	5,636	26	52
1956	299	420	1,886	2,618	26	79
1957	330	182	2,079	6,382	26	4
1958	[4] 314	186	[4] 2,452	3,676	28	177
1959	355	616	2,480	4,742	33	162
TOTAL PROVED RESERVES BY DEC. 31, 1959						
	4,660		59,854		1,358	

[1] Reserves based on American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vols. 4–14, 1949–59.
[2] Million barrels.
[3] Billion cubic feet.
[4] Revised figure.

According to the Oil and Gas Journal, 28.9 million feet of holes were drilled during the year, only 4 percent less than the record footage attained in 1957. The higher success ratio of exploratory wells was another bright spot in 1959 and may spur a step-up in exploratory drilling. Increased drilling activity in 1959 pointed up the trend toward more emphasis on development drilling.

The number of offshore rigs operating off Louisiana rose from 39 the last week of 1958 to 54 the last week of 1959.

Carbon Black.—Continental Carbon Co., Lake Charles, completed additions to its carbon black plant at a cost of $2.4 million and increased annual capacity from 45 million to 70 million pounds.

TABLE 7.—Carbon black production

Year	Million pounds	Year	Million pounds
1950–54 (average)	297	1957	534
1955	503	1958	503
1956	538	1959	599

Natural Gas.—Marketed production of natural gas continued a strong upward trend for the 14th consecutive year, and Louisiana retained second position in the Nation as a supplier of natural gas. National demand for this fuel and for raw material for petrochemicals con-

TABLE 8.—New oil and gas discoveries in 1959, by parishes[1]

Priash and field	Total depth (feet)	Production depth (feet)	Daily production rate		Type of product
			Barrels	Thousand cubic feet	
NORTH LOUISIANA					
Caddo: Missionary Lake	6,808	3,058- 3,068	50	----------	Oil.
Catahoula: Enterprise	7,936	7,806- 7,813	160	153	Do.
Long Branch	5,819	5,422- 5,426	60	----------	Do.
Prichard	8,103	7,973- 7,979	127	----------	Do.
South Prichard	4,236	4,128- 4,130	160	----------	Do.
Claiborne: East Blackburn	10,507	9,228- 9,236	199	2,700	Gas.
		10,254-10,340	65	890	
Concordia: Monterey	6,802	5,644- 5,646	90	45	Oil.
North Horseshoe	6,002	5,245- 5,247	77	----------	Do.
South Monterey	6,015	5,801- 5,806	33	----------	Do.
De Soto: Ten Mile Bayou	3,000	2,727- 2,730½	91.64	----------	Do.
Franklin: Winnsboro	4,772	4,604- 4,611	----------	1,665	Gas.
La Salle: West Saline Lake	6,000	5,489- 5,491	66	97	Oil.
West Trout Creek	3,224	2,173- 2,174	12	----------	Do.
Ouachita: Cheniere Brake	10,304	9,800- 9,804	21	250	Gas.
Cheniere Creek	10,301	6,477- 6,479	----------	3,400	Do.
		8,484- 8,502	----------	2,000	
Red River: Williams	3,006	1,712- 1,715	----------	1,650	Do.
Richland: Mangham	3,326	3,274- 3,278	66	----------	Oil.
Tensas: Buckhorn	8,775	8,691- 8,698	200	----------	Do.
North Lake Marydale	8,025	7,915- 7,925	----------	2,996	Gas.
Winn: Colgrade	1,307	1,302- 1,309	50	----------	Oil.
Union: Tick Creek	8,784	8,605- 8,606	134	.5	Do.
SOUTH LOUISIANA					
Acadia: Rork	9,540	9,460- 9,467	188	100.8	Oil.
Allen: Foley	9,518	9,094- 9,108	31	271	Do.
Beauregard: Skinner Lakes	8,136	7,710- 7,717	121.8	192	Do.
Calcasieu: Hickory Branch	8,718	8,519- 8,540	----------	----------	Gas.
Lake Charles	11,505	9,796- 9,814	112	1,600	Do.
Cameron: High Island	12,788	10,420-10,423	284	6,500	Do.
Lacassine Refuge	16,263	16,112-16,130	228	2,600	Do.
Little Cheniere Ridge	12,500	9,694- 9,697	207	47	Oil.
North Sabine Lake	11,134	11,070-11,080	141	2,800	Gas.
South Creole	12,621	11,110-11,115	28	3,406	Do.
Jefferson: West Fenton	11,056	10,414-10,419	176	320	Do.
Jefferson Davis: East Fenton	10,453	9,959- 9,962	72	430	Oil.
Lafayette: Judice	15,500	12,756-12,762	46	2,239	Gas.
Lafourche: Bayou Chevruil	13,364	12,980-12,990	84.96	2,060	Do.
Bayou Ferblanc	15,783	13,552-13,566	146	326	Oil.
Southwest Lake Boeuf	15,010	14,486-14,497	177	157	Do.
Plaquemines: Buras	11,450	9,486- 9,495	216	158	Do.
Empire	12,973	10,590-10,633	162	81	Do.
St. John the Baptist: Wallace	11,746	10,364-10,369	----------	3,000	Gas.
St. Landry: Pecaniere	12,706	11,026-11,042	156	1,918	Do.
St. Martin: Bayou La Rose	14,208	13,886-13,934	72	2,993	Do.
Terrebonne: Bayou Chauvin	13,020	10,768-10,777	33	2,450	Do.
Vermilion: Esther	12,456	12,160-12,164	28	1,980	Do.
Parcperdue	13,620	13,278-13,283	143	212	Oil.
Redfish Point	15,430	15,172-15,189	328	4,000	Gas.
OFFSHORE					
Iberia: Eugene Island Block 4	14,092	14,041-14,056	36	2,880	Gas.
Eugene Island Block 8	12,921	12,890-12,906	38	3,020	Do.
Plaquemines: Main Pass Block 12	11,000	10,079-10,085	----------	1,340	Do.
Vermilion: Vermilion Block 104	11,684	7,756- 7,761	----------	2,280	Do.

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[1] Louisiana State Department of Conservation, Annual Oil and Gas Report 1959: Pp. 8-11.

tinued to grow rapidly. Construction of offshore pipelines was continued. About 20 percent of the natural gas production was credited to north Louisiana (22 percent in 1958), 68 percent to south Louisiana (unchanged from 1958), and 12 percent to the offshore area (10 percent in 1958).

TABLE 9.—Oil and gas well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1959, by parishes[1]

Parish	Drilling							Geophysical, crew-weeks		
	Proved field wells			Exploratory wells			Total	Method		
	Oil	Gas	Dry	Oil	Gas	Dry		Reflection seismograph	Gravity meter	Total
Acadia	51	9	14	4	11	26	115	176	----	176
Allen	2	6	8	2	----	14	32	60	----	60
Ascension	4	5	2	----	1	5	17	14	----	14
Assumption	11	6	7	----	----	6	30	130	----	130
Avoyelles	----	----	----	----	----	2	2	3	12	15
Beauregard	7	5	25	6	2	14	59	128	----	128
Bienville	3	3	7	----	----	16	29	38	16	54
Bossier	5	10	7	----	2	18	42	23	----	23
Caddo	359	25	32	2	----	19	437	25	----	25
Calcasieu	19	9	24	5	6	31	94	103	49	152
Caldwell	----	1	----	----	1	4	6	8	----	8
Cameron	22	14	16	2	13	27	94	268	7	275
Catahoula	26	----	27	8	----	40	101	----	12	12
Claiborne	15	4	7	6	2	6	40	18	2	20
Concordia	19	----	29	3	----	25	76	----	4	4
De Soto	88	10	61	2	1	14	176	4	----	4
East Baton Rouge	1	----	1	----	----	----	2	1	----	1
East Carroll	----	----	----	----	----	2	2	7	----	7
East Feliciana	----	----	----	----	----	1	1	11	----	11
Evangeline	4	----	3	----	----	6	13	1	----	1
Franklin	2	----	7	----	1	13	23	15	2	17
Grant	16	----	9	----	----	6	31	----	----	----
Iberia	15	18	4	5	3	16	61	183	14	197
Iberville	29	2	3	1	----	9	44	76	19	95
Jackson	----	----	1	----	----	2	3	37	----	37
Jefferson	23	1	8	1	----	5	38	142	----	142
Jefferson Davis	2	6	9	3	3	27	50	43	----	43
Lafayette	----	4	4	1	6	13	28	58	----	58
Lafourche	73	22	27	8	14	24	168	235	----	235
La Salle	60	3	49	5	1	19	137	----	----	----
Lincoln	----	9	----	2	6	2	19	15	----	15
Livingston	----	----	----	----	----	1	1	2	----	2
Madison	----	----	----	----	----	5	5	52	6	58
Natchitoches	41	----	11	----	----	3	55	8	2	10
Orleans	----	1	----	----	----	----	1	16	----	16
Ouachita	----	7	1	----	4	----	12	20	----	20
Plaquemines	136	25	23	8	1	30	223	133	----	133
Pointe Coupee	2	----	3	1	----	6	12	22	----	22
Rapides	----	----	1	1	----	2	4	20	----	20
Red River	22	19	22	----	2	13	78	4	----	4
Richland	6	1	4	1	----	1	13	13	----	13
Sabine	11	----	2	----	1	4	18	----	----	----
St. Bernard	1	1	1	----	----	2	5	16	----	16
St. Charles	15	2	9	1	1	9	37	47	----	47
St. Helena	----	----	----	----	----	----	----	36	2	38
St. James	----	1	2	1	----	1	5	22	----	22
St. John the Baptist	10	----	4	----	1	4	19	44	----	44
St. Landry	8	6	11	1	8	13	47	76	2	78
St. Martin	35	4	31	2	6	16	94	133	55	188
St. Mary	66	8	13	12	8	29	136	174	----	174
St. Tammany	----	----	----	----	----	2	2	12	----	12
Tangipahoa	----	----	----	----	----	----	----	----	2	2
Tensas	13	2	8	2	2	16	43	38	5	43
Terrebonne	109	54	27	1	11	40	242	300	2	302
Union	----	46	----	1	1	7	55	10	----	10
Vermilion	15	20	17	3	13	45	113	399	----	399
Vernon	----	----	----	----	----	2	2	43	----	43
Washington	----	----	----	----	----	----	----	2	2	4
Webster	30	6	18	4	----	3	61	3	3	6
West Baton Rouge	----	----	3	----	----	1	4	4	----	4

See footnote at end of table

TABLE 9.—Oil and gas well drilling and total crew-weeks spent in geophysical oil and gas prospecting in 1959, by parishes [1]—Continued

Parish	Drilling							Geophysical, crew-weeks		
	Proved field wells			Exploratory wells			Total	Method		
	Oil	Gas	Dry	Oil	Gas	Dry		Reflection seismograph	Gravity meter	Total
West Carroll						2	2	24		24
West Feliciana						1	1			
Winn	9		6	2		20	37	10	6	16
Total: 1959	1,385	375	608	107	132	690	3,297	3,505	224	3,729
1958	1,297	372	628	73	120	624	3,114	4,517	353	4,870
Offshore:										
Bay Marchand	23	2	4				29			
Breton Sound				1		1	2	6	1	7
Cameron, East		6	3			4	13	17	7	24
Cameron, West	1	5	2		3	2	13	32	8	40
Chandeleur Sound			1				1			
Delta, West	59	3	13	2	4	2	83	14		14
Eugene Island	38	9	22	6	8	4	87	92	17	109
Grand Isle	28		2	1		2	33	7	2	9
Main Pass	13	3	9			4	29	12	1	13
Marsh Island, South	6	5	1	1	1	2	16	15	2	17
Ship Shoal	2	8	4	2	4	4	24	22	8	30
South Pass	91	3	9				103	16		16
Timbalier, South	21	1	10		1	2	35	23	2	25
Vermilion	2	13	8	1	2	8	34	38	4	42
Total: 1959	284	58	88	14	23	35	502	294	52	346
1958	223	42	77	10	19	29	400	172	117	289
Grand total:										
1959	1,669	433	696	121	155	725	3,799	3,799	276	4,075
1958	1,520	414	705	83	139	653	3,514	4,689	470	5,159

[1] International Oil Scouts Association, International Oil and Gas Development, Austin, Tex., vol. 30, 1959.

TABLE 10.—Marketed production gross withdrawals and disposition of natural gas in Louisiana, in million cubic feet

Year	Withdrawals [1]			Marketed production [2]	Value at wells (thousands)	Disposition	
	From gas wells	From oil wells	Total			Repressuring	Vented and wasted [3]
1950-54 (average)	1,145,824	324,040	1,469,864	1.163,196	$83,745	205,444	101,224
1955	1,523,000	425,000	1,948,000	1,680,032	189,844	201,764	66,204
1956	[4] 1,696,000	[4] 450,000	[4] 2,146,000	1,886,302	215,038	190,768	[4] 68,930
1957	1,877,000	470.000	2,347,000	2,078,901	232,837	187,057	81,042
1958	2,223,000	505,000	2,728,000	2,451,587	316,255	220,616	55,797
1959	2,442,000	514,000	2,956,000	[5] 2,766,129	[5] 324,900	186,599	99,130

[1] Marketed production, plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Partly estimated. Includes direct waste on producing properties and residue blown to the air.
[4] Revised figure.
[5] Preliminary figure.

A new market for natural gas was established. The SS *Methane Pioneer* had delivered seven cargoes of liquid methane to England. Each 32,000-barrel cargo of liquid methane was reconverted to about 107 million cubic feet of natural gas and pumped into London's gas supply pipelines. Methane is the principal component of natural gas, and when liquefied at minus 258° F. it is reduced to one six-hundredth of its volume. The experiment proved that the liquefaction, ocean transport, and storage of methane were technically and economically feasible. Liquid methane tankers and pipelines were competitive for distances greater than 1,000 miles.

The largest gas-sale contract in the State in 1959, between Continental, Atlantic Refining, Tidewater and Cities Service (CATCO), and the Tennessee Gas Transmission Co., which had been approved by the Federal Power Commission at a sale price of 22.4 cents a thousand cubic feet, was overruled by the U.S. Circuit Court of Appeals in Philadelphia. The producers refused to sell gas at the recommended price of 16 cents a thousand cubic feet and the case was appealed to the Third U.S. Circuit Court of Appeals in Philadelphia. In 1959 the case proceeded by appeal from the Third Circuit Court to the U.S. Supreme Court. That court remanded the case to the Federal Power Commission with instructions to the Commission to develop the record fully as to the costs to the producers of the gas to be sold to Tennessee Gas Transmission Co. The cost of the service phase of this rehearing before the Commission was established, but no order was issued by the Federal Power Commission as to the sale price to be allowed.

TABLE 11.—Natural-gas liquids production

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	654,595	$50,416	284,624	$12,506	939,219	$62,922
1955	782,328	59,158	291,138	10,323	1,073,466	69,481
1956	773,949	62,394	305,222	14,727	1,079,171	77,121
1957	775,009	63,956	335,142	14,888	1,110,151	78,844
1958	783,099	50,371	410,869	21,435	1,193,968	71,806
1959	846,110	60,295	540,046	25,877	1,386,156	86,172

Natural-gas Liquids.—Louisiana attained second place in the Nation as a producer of natural-gas liquids. Natural gasoline and cycle products were recovered by 71 plants in 26 parishes—a net gain of 7 plants during the year. Increased output in 1959 of total condensable liquids was attributed mainly to a gain in natural gas produced and processed, especially casinghead gas from oil wells. A 31-percent gain (23 percent in 1958) in LP-gases represented most of the increased output of condensable liquids. This gain confirmed the trend in natural gasoline plants to remove more butane from natural gasoline and process the remaining heavier components to higher quality blending stocks for motor fuels. The LP-gas consumption pattern continued to change, more being used in chemicals and fuels and less for blending into motor fuels at refineries.

In November, South Louisiana Production Co., Inc., St. Mary Parish, completed its new Jeanerette plant which produces butane, propane, and natural gasoline.

Texas Natural Gasoline Corp., Rayne, Acadia Parish, completed its new Toca plant No. 12 at a cost of $11.5 million. The plant was designed to process approximately 700 million cubic feet of raw gas daily and produce over 350,000 gallons of natural-gas liquids (propane, butane, and natural gasoline). It went on stream during January 1959.

Union Oil Co. and the Goliad Corp. were building two new natural gasoline plants in south Louisiana costing $12 million and scheduled for completion in 1960. The companies were building a new refrigerated oil-absorption plant at Kaplan with a capacity to process 450 million cubic feet of natural gas a day. An 85-mile pipeline was to connect this plant with a new fractionating plant to be built near the Wyandotte Chemical Co.'s plant at Geismar, on the east bank of the Mississippi River south of Baton Rouge.

Magnolia Petroleum Co., Cameron Parish, completed additions to its natural gas processing plant at a cost of $2.4 million.

Central Louisiana Electric Cooperative (Cleco) completed a gasoline plant 5 miles east of Jeanerette at a cost of $260,000. The plant will process 25 million cubic feet of natural gas a day to extract approximately 7,000 gallons of natural gasoline and about 4,500 gallons of butane and propane. It is the first commercial plant in Louisiana to use the dry dessicant method for recovering butane and propane from natural gas.

Sunray Mid-Continent Oil Co., Bossier Parish, was expanding propane recovery facilities. Completion was scheduled for July 1960.

Tidewater Oil Co. let a contract to build a 75-million-cubic-feet-a-day plant in the Hollywood-Houma fields, Terrebonne Parish. This plant will process separator residue gas, currently produced through lease separators, using a low-temperature absorption process. Recovery will be 1,030 barrels of liquids daily. Completion was expected late in 1960. O. L. Olsen Co., Houston, was the contractor on the $1.5 million project.

Runnels Gas Products Corp. and Texas Gas Exploration Corp. completed additions to their propane, isobutane and normal butane, and natural gasoline recovery facilities at a cost of $500,000.

LaGloria Oil & Gas Co., Rayne, Acadia Parish, completed construction of a new absorption-type gas processing plant at a cost of $4 million.

Petroleum.—Although petroleum allowables for Louisiana had not been increased since September 1, 1958, the production of 354.6 million barrels in 1959 established a new record. The gain of 13 percent over 1958 came from new discoveries, hence, production gain reflected the increase in successful completions in 1959. About 12 percent of the crude oil production was credited to north Louisiana (14 percent in

TABLE 12.—Production of crude petroleum

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	237,673	$651,562	1958	313,891	$1,023,517
1955	271,010	793,280	1959 [1]	354,611	1,120,115
1956	299,421	877,951	1902–59	5,108,199	11,622,256
1957	329,896	1,094,402			

[1] Preliminary figures.

1958); 68 percent to south Louisiana (unchanged from 1958); and 20 percent to the offshore area (18 percent in 1958).

TABLE 13.—Indicated demand, production, and stocks of crude petroleum by months, 1959, in thousand barrels

Month	Indicated demand	Production	Stocks (end of month)	Month	Indicated demand	Production	Stocks (end of month)
January	28,688	29,224	16,763	September	29,818	29,380	17,119
February	25,572	26,583	17,774	October	30,556	31,541	18,104
March	28,452	28,195	17,517	November	31,442	31,016	17,678
April	28,631	28,884	17,770	December	32,939	32,608	17,346
May	30,272	30,029	17,527				
June	27,457	28,346	18,416	Total:			
July	28,768	28,901	18,549	1959	353,490	354,611	----------
August	30,896	29,904	17,557	1958	316,908	313,891	----------

TABLE 14.—Number of producing oil wells and average production per well

Year	Number of producing wells as of Dec. 31	Average production per well per day (42-gallon barrels)	Year	Number of producing wells as of Dec. 31	Average production per well per day (42-gallon barrels)
1950–54 (average)	13,568	50.0	1957	21,945	42.2
1955	18,800	42.7	1958	23,070	38.1
1956	20,905	41.2	1959	23,468	41.8

Increased optimism and drilling activity in the offshore areas at the end of 1959 resulted from the following factors: (1) Drilling costs tended to fall with new drilling techniques and additional experience, (2) multiple completions enhanced the final payoff, (3) expanding gas markets spurred development in some fields, and (4) the discovery ratio improved. Some wells could be drilled at half the cost required a few years before. One company recently drilled a 10,000-foot well in 4 days and 22 hours—a feat that might have required 45 to 50 days in 1950. Statistics on multiple completions in offshore Louisiana have not been compiled; however, at least three companies had quadruple completions, over a dozen had triple completions, and virtually all had dual completions. A dual completion increases the cost of a single well about 25 percent. As each completion rates a full allowable under Louisiana conservation rules, the economics of the technique is favorable.

Pressure maintenance or secondary recovery of oil became increasingly important in 1959. According to the Department of Conservation, secondary recovery was applied to 143 reservoirs in 69 fields. It was estimated that the total would reach 180 reservoirs by the end of 1960. In 1929 only 585,600 barrels of oil was recovered by secondary recovery methods; in 1959 secondary recovery accounted for 28,152,612 barrels or 8 percent of the total annual production of the State. Unitization of leases was necessary but difficult, and little progress was made in secondary recovery until the Louisiana Legislature passed Act 157 of 1940. This act gave the Commissioner of Conservation the power to "force pool" a field or reservoir for cycling and to regu-

TABLE 15.—Production of crude petroleum, by districts and fields, in thousand barrels

District and field	1958	1959 [1]
Gulf Coast:		
Anse la Butte	1,656	1,775
Avery Island	2,580	2,712
Bateman Lake	2,191	2,836
Barataria	800	761
Bay de Chene	1,600	1,913
Bay Marchand	4,684	6,390
Bay St. Elaine	3,338	3,764
Bayou Blue	913	743
Bayou Choctaw	1,131	1,361
Bayou Mallett	829	981
Bayou Sale	2,297	3,138
Bully Camp	1,236	1,452
Caillou Island	11,260	14,751
Charenton	1,228	1,573
Cox Bay	1,565	1,348
Delta Farms	3,285	3,656
Dog Lake	755	770
Duck Lake	2,282	2,483
East White Lake	1,111	1,044
Egan	1,839	1,773
Erath	1,365	1,201
Garden Island	1,373	1,672
Gibson	809	853
Golden Meadows	2,649	2,500
Good Hope	859	855
Grand Bay	3,178	3,084
Gueydan	800	923
Hackberry	5,914	5,706
Horseshoe Bayou	722	760
Iberia	785	841
Iowa	1,743	1,553
Jeanerette	1,147	1,219
Jennings	1,301	1,439
Lafitte	2,670	3,176
Lake Arthur South	1,077	1,531
Lake Barre	2,577	4,336
Lake Chicot	721	783
Lake Fausse Point	1,499	1,651
Lake Pelto	3,102	4,086
Lake Salvador	1,635	2,067
Lake Washington	9,682	11,098
La Rose	1,021	1,133
Leeville	3,711	3,829
Little Lake	2,096	2,509
Lockport	768	795
Main Pass	9,672	9,581
Gulf Coast—Continued		
North Crowley	924	1,008
Paradis	2,286	2,479
Phoenix Lake	1,042	1,231
Pine Prairie	692	577
Point a La Hache	915	----------
Port Barre	680	781
Quarentine Bay	2,765	2,953
Romere Pass	2,638	2,807
St. Gabriel	597	529
Section 28	1,101	1,093
Shuteston	979	902
South Pass	10,359	7,168
Tepetate	1,418	1,442
Timbalier Bay	8,562	10,202
University	508	446
Valentine	2,302	2,981
Venice	4,317	4,411
Ville Platte	794	805
Vinton	1,756	1,777
Weeks Island	6,871	7,318
West Bay	3,705	4,275
West Cote Blanche	2,989	2,967
West Lake Verrett	1,259	1,245
White Castle	842	887
Other Gulf Coast	102,601	124,338
Total	272,358	309,027
Northern:		
Big Creek	476	483
Caddo	7,066	6,880
Cotton Valley	771	823
Delhi	4,931	5,086
Esperance Point	1,415	1,337
Haynesville	3,213	3,003
Lake St. John	2,072	1,845
Nebo [2]	1,468	1,523
Olla [3]	1,432	1,583
Rodessa	597	683
Sligo	1,277	1,405
Urania	766	812
Other Northern	16,049	20,121
Total	41,533	45,584
Grand total	313,891	354,611

[1] Preliminary figures.
[2] Includes Hemphill, Trout Creek, and Jens.
[3] Includes Little Creek and Summerville.

late secondary recovery. Offshore Louisiana, the youngest producing area, already had turned to secondary recovery operations to assure the highest possible recoveries in an attempt to offset high operating costs.[3]

Gulf Oil Corp. completed an oil well from a platform erected in 210 feet of water in offshore Louisiana. On the 2-hour test, the well was given a daily potential of 233 barrels of 29.7° API gravity oil.

Refineries.—At the end of 1959, 12 petroleum refineries, including cracking plants, were operating in Louisiana. One refinery was inactive. The crude-oil capacity (barrels a day) was as follows: Operating 760,500, standby 8,500, total 769,000 and under construction 11,000. Cracked-gasoline capacity (barrels a day) was as follows: Operating 238,200, shutdown 26,000, total 264,200, and under construction 500.

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[3] Peterson, A. Fred, Jr., and Hudson, Carlton V., Secondary Recovery and Pressure Maintenance Operations in Louisiana: 1959 Report, Department of Conservation, 165 pp.

Modernization of the Bay Petroleum Co., a division of Tennessee Gas and Transmission Co., Chalmette refinery, was nearing completion and scheduled to go on stream during February 1960. Crude oil capacity was increased from 26,000 to 37,000 barrels a day.

Esso Standard, a division of Humble Oil & Refining Co., Baton Rouge, was increasing fluid catalytic cracking fresh-feed capacity from 141,000 to 142,500 barrels daily and recycling capacity from 59,000 to 60,800 barrels, with completion scheduled for April 1960.

Continental Oil Co. completed a $3 million catalytic re-forming unit at its Lake Charles refinery. The new unit has a capacity of 11,000 barrels of gasoline a day and will permit the refinery to produce higher octane gasoline.

Delta Petroleum Co., Inc., New Orleans, completed additions to its lubricating, oil compounding, and blending plant at a cost of $250,000 in December.

Petrochemicals.—The petrochemicals industry was placing more emphasis on market development, accelerating the quest for new products and new uses for products already developed, and searching for unexploited markets. Most petrochemicals are derived from refinery still gases and from condensable liquids recovered from natural gas. It has been estimated that there are 2,500 uses for the products made from petrochemicals, all resulting from chemical research. They include antifreeze, pharmaceuticals, synthetic fibers, nitrogen fertilizers, soil conditioners, synthetic rubber, plastics, insecticides, detergents, and a wide variety of other chemicals. The ethylene used to make polyethylene resins is worth 35 times the worth of the natural gas used to make it, illustrating the value added by manufacturing. Over $72 million was invested in new chemicals and petrochemical plants and in additions to and modernizations of existing facilities in 1959. The phenomenal growth of the industry was indicated by employment. In 1942 only 4,750 workers were employed in the chemical and petrochemical industry; in 1959, 12,300 were employed. This figure includes workers at separate petrochemical plants only; it does not include workers at petrochemical plants within the petroleum refineries.

Continental Oil Co. planned to begin construction of a plant at Lake Charles, Calcasieu Parish early in 1960 to manufacture petroleum-derived industrial alcohols which formerly were produced only from natural fats and oils. Capacity will exceed 50 million pounds a year of straight-chain primary alcohols for use in manufacturing detergents, plastics, cosmetics, textiles, etc. Raw material will be ethylene. The plant, scheduled for completion early in 1961, will cost an estimated $10.7 million.

Hercules Powder Co., Lake Charles, was building a new $16 million polypropylene plant with a capacity of more than 100 million pounds a year. The first 50-million-pound unit was scheduled to go on stream early in 1961. Polypropylene is a plastic resin product used in manufacturing of film, automobile seat covers, webbing, and molded plastic items.

American Cyanamid Co., Jefferson Parish, completed additions to its Fortier plant, which increased acrylonitrile output capacity from 50 million pounds annually to 100 million pounds. Acrylonitrile is used to make synthetic fiber, synthetic rubber, and latex, also as an intermediate for making plastic molding compounds and coatings for the paper industry.

Dow Chemical Co., Plaquemine, Iberville Parish, began constructing a new polyethylene pellets plant in June, estimated to cost $12 million, and scheduled to go on stream in October 1960. Dow established its Louisiana Division early in 1956; the latest project, estimated to cost $30 million, called for new ammonia units, to produce both anhydrous and aqueous ammonia, and expanded production capacity for vinyl chloride, chlorine, and caustic soda, to be completed within 2 years. Power and steam generating capacity also would be increased. When these programs are finished, Dow's investment in the State will be over $100 million.

Olin-Mathieson Chemical Corp., Lake Charles, completed new facilities at its ammonia plant during August at a cost of $214,000.

Firestone Tire and Rubber Co., Lake Charles, completed additions to its synthetic rubber plant at a cost of $1.7 million in December. The original capacity, 66,000 long tons per year (1943), was expanded to 190,000 long tons per year.

Universal Oil Products Co., Shreveport, completed additions to its synthetic catalyst plant at a cost of $80,000 in December.

Columbia-Southern Chemical Corp. was constructing an ethylene dichloride plant at the company's Lake Charles facility. The new plant, to cost more than $1 million, adjoins the firm's chlorine and caustic soda manufacturing operation. Initial production was scheduled for September 1960.

Esso Standard, a division of Humble Oil & Refining Co., announced plans for a $16 million expansion of production facilities for butyl rubber at the company's Baton Rouge petroleum refinery and chemical plant. The plant modifications and expansion will add 20,000 long tons of capacity in mid-1960 and another 18,000 long tons in 1961. The total capacity of the Esso and Humble plants will reach more than 135,000 long tons per year.

Falcon Chemical Corp., Lake Charles, completed a new $275,000 plant to produce industrial-grade methanol and furfural.

W. R. Grace and Co., Polymer Chemicals Division, Baton Rouge, completed additions to its high-density polyethylene plastic facilities in December at a cost of $1 million.

Allied Chemical Corp., Solvay Process Division, Baton Rouge, completed additions to its alkalies, chlorine, and other chemical facilities in August.

Ethyl Corp., Baton Rouge, completed additions to its plant for producing gasoline antiknock compounds, vinyl chloride monomer, and other chemicals at a cost of $300,000.

Timcoat Corp., Plaquemines Parish, constructed a new $1.5 million plant and began producing rubberized asphalt mastic for marine pipeline coating.

Copolymer Rubber & Chemical Corp., Baton Rouge, which produced the first bale of synthetic rubber on a commercial scale, completed plant additions that cost $387,683 and announced a further $3 million expansion program. The new facilities will increase the company's capacity from 49,000 to 125,000 long tons of rubber a year.

Wyandotte Chemical Corp.'s Geismar plant completed the first unit of its 150-ton-a-day caustic soda and chlorine plant early in 1959. The second 150-ton-a-day unit was completed a few months later. Wyandotte's salt dome, within easy reach of the Geismar plant, has ample reserve to supply brine for chlorine and caustic soda production for many years. The company's ethylene oxide and ethylene glycol plants were completed in 1958.

Shell Chemical Corp. announced approval of a $10 million expansion of its Norco production facilities. Construction was underway on a new facility to manufacture 35 million pounds of synthetic glycerine a year, as well as substantial quantities of acrolein, a chemical used in manufacturing plastics, resins, textiles, and pharmaceuticals. The company also completed a new research and analytical laboratory and was constructing new asphalt producing facilities at its Norco plant.

NONMETALS

Barite.—Crude barite from Arkansas, Missouri, and foreign countries was ground in Louisiana for use in oil-well drilling muds. Three grinding plants are located at New Orleans and one at Lake Charles. Ground barite production increased 12 percent and shipments 16 percent over 1958, reflecting the increase in petroleum and natural-gas drilling.

Cement.—Portland cement production at the State's three plants continued to increase. Despite a decline of 2.5 percent in the value of construction contracts awarded, apparent consumption of all types of cement gained 11 percent, a new record. Production of sand and gravel increased 7 percent, also a new record. Two factors contributed to this apparent inconsistency: (1) At major highway construction projects, the grading had been completed in 1958 and more concrete pavement was being poured, and (2) dredging contracts were awarded that required little or no construction materials.

Lone Star Cement Corp. completed a $520,000 truck-loading facility at its New Orleans plant. At Lake Charles, the company completed additions to its portland and masonry cement plant at a cost of $376,800. Ideal Cement Co. completed new stacks and a dust-collecting system at its Baton Rouge plant at a cost of $277,000.

Clays.—Production of miscellaneous clays gained 20 percent. Clays used for lightweight aggregate, heavy clay products, and cement increased 71, 8, and 3 percent, respectively. Nearly 213,000 tons of

TABLE 16.—Shipments of all types of portland cement to Louisiana from mills

Year	Louisiana (thousand barrels)	Change, percentage	
		In Louisiana	In United States
1950–54 (average)	5,551		
1955	7,340	+17	+6
1956	8,507	+16	+6
1957	7,585	−11	−6
1958	8,048	+6	+6
1959	8,908	+11	+9

local clay was used to manufacture heavy clay products at 12 brick plants in 11 parishes. Lightweight aggregate was produced at Alexandria, Rapides Parish; Erwinville, Pointe Coupee Parish; and north of Shreveport, Caddo Parish.

Caddo Light Aggregate Co., Inc., completed a lightweight aggregate plant about 20 miles north of Shreveport to use locally mined clay. Big River Industries, Inc., Erwinville, Point Coupee Parish, completed additions to its lightweight aggregate plant in October at a cost of $150,550.

Bentonite, mined only in Lincoln Parish, was used for filtering and decolorizing mineral and vegetable oils. Louisiana Geological Survey discovered a deposit of bentonite, estimated at more than 700,000 tons, near Homer, Claiborne Parish. The deposit, which is more than 2 feet thick over 72 acres and 10 feet thick over 6 acres and has a maximum overburden of 30 feet, is the largest and most accessible deposit known in Louisiana. Arkansas Louisiana Gas Co. announced plans to develop the deposit and produce bentonite.

TABLE 17.—Miscellaneous clay sold or used by producers[1]

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	468	$561	1957	642	$642
1955	651	659	1958	755	755
1956	785	785	1959	904	904

[1] Excludes bentonite.

Gypsum.—Anderson & Dunham, Inc., Winn Parish, mined crude gypsum for aggregate in road construction and as a retarder in portland cement. National Gypsum Co. and United States Gypsum Co. calcined imported crude gypsum and manufactured plaster, lath, and wallboard.

Bestwall Gypsum Co. was building a $6.6 million gypsum plant in New Orleans to process about 200,000 tons of imported gypsum a year for producing plaster, lath, and gypsum board. The plant, on the new Mississippi River-Gulf outlet, was scheduled for completion in September 1960.

Lime.—United States Gypsum Co. was building a new lime plant along the Inner Harbor Navigation Canal at New Orleans. The 10-acre site is adjacent to the company's gypsum manufacturing plant. The $1.5 million plant was to produce building lime and quick and hydrated lime, using clam shells dredged from Lake Pontchartrain as the raw material. A 10- by 250-foot rotary kiln was to be used for calcining the shell. The plant was scheduled for completion in September 1960.

Pelican State Lime Corp., Morgan City, St. Mary Parish, completed new lime manufacturing facilities at an estimated cost of $1.5 million. The corporation's new plant is designed to make 150 to 175 tons daily of quick and hydrated lime from shells dredged from a State lease in Vermilion Parish.

Nitrogen Compounds.—Air Reduction Sales Co. was building a $2 million air-separation plant to manufacture high-purity liquefied industrial gases at the old Ronaldson airport near Baton Rouge. The plant will have a daily production capacity of 30 tons of liquid oxygen, nitrogen, and argon.

Salt.—Apparent production of salt increased 40 percent over 1958. Improved coverage of salt producers resulted in the addition of 904,853 tons of salt (96 percent brine and 4 percent rock) in 1959. On the basis of previous coverage, the 1959 production of salt was 3,902,143 tons, a gain of 13 percent over 1958 and a new record output. The 1959 figures fully cover the use of salt for making caustic soda, soda ash, chlorine, sodium metal, and other chemicals and reflect the gains in the petrochemical and chemical industries. The two new alumina plants, Ormet Corp. (completed in 1958) and Kaiser Aluminum & Chemical Corp. (completed in May 1959), used large quantities of caustic soda.

Morton Salt Co. changed its mining method at the massive salt dome at Weeks Island. Rooms were driven 50 feet wide and 25 feet high, leaving 100-foot-wide pillars. Originally, an additional 50 to 65 feet was taken off the roof, but this method created several problems. Scaling the roof was especially troublesome in rooms 50 to 90 feet high. Benching proved more feasible and effected substantial savings over previous production methods. The new face undercut 8½ feet deep with a coal undercutter to provide a smooth floor, then vertical holes are drilled 30 feet deep and the entire face is blasted.

TABLE 18.—Salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	2,744	$8,533	1957	3,461	$18,944
1955	3,563	15,407	1958	3,442	18,960
1956	3,704	17,695	1959	4,807	20,918

TABLE 19.—Production of salt, by types
(Thousand short tons and thousand dollars)

Type	1956		1957		1958		1959	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Evaporated salt	122	$1,995	128	$2,692	131	$2,959	168	$4,279
Rock salt	1,294	8,516	1,335	9,802	1,349	9,729	1,601	10,959
Brine	2,238	7,185	1,998	6,450	1,962	6,272	3,038	5,680

Sand and Gravel.—Production of more than 16 million tons of sand and gravel (a new record) represented an increase of 7 percent over 1958 and resulted from increased construction. Washed sand and gravel output was more than 14 million tons or 89 percent of the total. Sand use was distributed as follows: Building sand, 46 percent; paving sand, 41 percent; other construction sand, 7 percent; fill sand, 4 percent; railroad ballast, blast sand, and engine sand, 2 percent. Gravel consumption was as follows: Paving gravel, 51 percent; building gravel, 37 percent; other construction gravel, 10 percent; fill gravel, 1 percent; all other uses, 1 percent. There were 70 producers of sand and gravel in 22 parishes.

Owens-Illinois Glass Co., Toledo, Ohio, announced plans to construct a $3 million glass-container plant on a 24-acre site on the Industrial Canal near New Orleans. The plant was designed to produce 50,000 tons of bottles and jars and would require 55,000 tons of raw material each year.

TABLE 20.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	5,816	$6,959	253	$104	6,069	$7,063
1955	8,338	10,759	236	183	8,574	10,942
1956	14,820	18,555	254	85	15,074	18,640
1957	12,477	14,659	102	70	12,579	14,729
1958	14,610	16,982	451	137	15,061	17,119
1959	15,505	19,898	547	213	16,052	20,111

Stone.—The entire stone production was shell (clam and oyster). More than 5.6 million short tons of shell valued at over $10.9 million was dredged and marketed, a gain of 4 percent in quantity and 14 percent in value over 1958. Louisiana lacks an adequate supply of stone and relies on shell as a substitute. Shell, which is almost pure calcium carbonate, meets the highest chemical specifications. Shell consumption was as follows: For concrete aggregate and road construction, 74 percent; as a cement raw material, 17 percent; burned to make lime, 8 percent; and as a paint filler, rubber filler, and mineral food, 1 percent.

Sulfur.—Shipments, or apparent consumption, of Frasch sulfur reached a new peak in 1959, despite a smaller demand for sulfuric acid from the strike-bound steel industry. Normally, the steel industry is a major consumer of sulfuric acid, accounting for about 7 percent of the total sulfur used in the Nation. The loss of sulfur sales to the steel industry was more than offset by the increase in sales to such large sulfur-consuming industries as fertilizers, chemicals, pulp paper, pigments, and rayon. Although production of Frasch sulfur declined 1 percent from 1958, the increased demand was met with 217,000 long tons of sulfur shipped from Frasch stockpiles.

TABLE 21.—Sulfur produced and shipped from Frasch mines

(Thousand long tons and thousand dollars)

Year	Production	Shipments	
		Quantity	Value
1950–54 (average)	1,543	1,464	$34,760
1955	2,081	2,072	58,028
1956	2,429	2,239	59,330
1957	2,125	2,156	$52,690
1958	2,055	2,028	47,651
1959	2,035	2,252	52,779

The world's first offshore sulfur mine—an enormous steel island rising high above the waters of the Gulf of Mexico—was scheduled to begin commercial production early in 1960. Construction of Freeport Sulphur Co.'s Grand Isle offshore sulfur-mining plant was virtually completed during 1959. A description of the operation follows: Steel towers, connected by 200-foot-long bridge spans, support the major installations required by the Frasch mining process. The lower floor is 60 feet above the water so as to be clear of hurricane waves. The unit containing the heating plant, shops, and warehouse is the largest installation. The heating plant has an average daily capacity of 5 million gallons of water, which is heated to 325° F. The facility is the third largest Frasch plant in existence. Drilling and production installations are at the opposite end of the half-mile-long steel island. The drilling rig can be moved to 36 openings on the platform. It was planned to drill about three directional wells through each opening. The sulfur is melted underground by superheated water and forced to the surface in molten form with compressed air. One unique feature of this mine is the heated pipeline, sunk in the bottom of the gulf, which will carry liquid sulfur to the Grand Isle land base. The 7-mile line consists of three concentric pipes, which are heavily insulated to retain the temperature of the flowing sulfur at a minimum of 280° F. The innermost 6-inch line, carrying the sulfur, is surrounded by a 7⅝-inch line carrying water at 320° F., which, in turn, is surrounded by insulation in a 14-inch casing. The principal problem presented by the pipeline was the thermal stress, which would normally cause the inner line to expand about 55 feet when heated to operating temperature. Expansion joints, or loops, the usual means of providing for such expansion in aboveground lines, were not feasible. Instead, the outer pipe (casing) was stretched under 10,000 pounds-per-square-inch tension and fixed to anchors while in tension, then the inner pipes were heated and allowed to expand to their normal length. While in this expanded condition they were fastened to the outer casing; thus, when the lines are in operation, the thermal stress will be compressive, thereby reducing longitudinal movement to almost zero. Another installation is a two-story, air-conditioned, steel building that houses living quarters, offices, cafeteria, recreation rooms, and two television viewing rooms. Only half of the operating crew is at the mine at one time. The working crew time is rotated in 5-day shifts.

Freeport Sulphur Co. closed its Bay Ste. Elaine sulfur operation in December 1959, owing to depletion of reserves. The mining barge containing the boilers, pumps, and other mining equipment, used at Bay Ste. Elaine for 7 years, was towed to Lake Pelto. The Lake Pelto sulfur deposit is 36 miles south of Houma. The Isles Dernieres form a partial barrier between the Gulf of Mexico and the artificial island constructed to house mining facilities. The mining barge was being rehabilitated and office, living quarters, and recreation facilities were being constructed. Production was scheduled to begin in the fall of 1960.

METALS

Aluminum.—Kaiser Aluminum & Chemical Corp. completed construction of its new $70 million alumina plant at Gramercy and started production in May. The plant, on the east bank of the Mississippi River halfway between New Orleans and Baton Rouge, has an annual capacity of 430,000 tons of alumina. The company drilled a well into the Sorrento salt dome in Ascension Parish and constructed a 14-mile pipeline to deliver brine to the $8 million caustic soda and chlorine plant that was completed in 1958 at Gramercy. The caustic soda was used in the alumina process, and the byproduct chlorine was sold. Bauxite was processed from the corporation's mines in Jamaica, British West Indies. Kaiser also completed construction of additional facilities for pig and ingot casting and direct chill casting of ingots at its Chalmette aluminum smelter at a cost of $1.4 million. At yearend, eight potlines were in operation and one was idle. Production of alumina at Kaiser's Baton Rouge alumina plant continued.

Ormet Corp., owned jointly by Olin-Mathieson Chemical Corp. and Revere Copper & Brass, Inc., continued producing alumina at its Burnside plant.

Iron Ore.—Iron ore resources of Claiborne Parish were investigated by the Louisiana Geological Survey during 1959. The ore was similar in character and occurrence to the ore being mined in east Texas. The investigations were to be extended to surrounding parishes in 1960.

The Burnside Bulk Marine Terminal, 30 miles south of Baton Rouge on the Mississippi River, was used to transfer foreign iron ore from ocean ships to barges for shipment to steel mills in the St. Louis and Chicago areas. The terminal also was used to unload ships carrying bauxite to the adjacent Ormet Corp. alumina plant and to load barges with alumina for shipment up the Mississippi and Ohio Rivers.

Mike Safer Co., Inc., completed an addition to its steel-scrap processing facilities.

Nickel-Cobalt.—Freeport Nickel Co. completed construction of its nickel-cobalt refinery at Port Nickel during the year. Moa Bay Mining Co., Freeport Nickel Co. subsidiary, commenced producing nickel-cobalt sulfide concentrate at its mining and ore-concentrating facilities in Oriente Province, Cuba, in November 1959. The initial shipment of concentrate reached the Port Nickel refinery at yearend. Successful test runs were made at the refinery, and the technical feasibility of the process was fully demonstrated; nickel metal was produced which met the highest commercial specifications. In 1959, Cuba passed legislation imposing a 5-percent tax on the value of minerals mined in Cuba plus a 25-percent tax on the value of minerals exported from Cuba. In addition, Freeport Nickel needed to borrow $13.5 million to complete the construction of the $119-million project and carry on commercial production. This was impossible because of the new Cuban mining law (Law 617 of Oct. 27, 1959).

REVIEW BY PARISHES

Minerals were produced in all but 2 of the State's 64 parishes. Gases and liquid hydrocarbons were produced in 57 parishes; other minerals in 41 parishes. Parishes that reported mineral production valued at over $100 million were: Plaquemines, $347 million; Terrebonne, $157 million; and Lafourche, $151 million. Six parishes (five in 1958) reported values of $50 million to $100 million: St. Mary, $94 million; Cameron, $86 million; Iberia, $67 million; Acadia, $63 million; Vermilion, $61 million; and Jefferson, $56 million. Forty-nine parishes produced minerals valued at more than $1 million.

TABLE 22.—Value of mineral production in Louisiana, by parishes[1][2]

Parish	1958	1959	Minerals produced in 1959 in order of value
Acadia	$57,264,859	$63,113,777	Petroleum, natural gas, natural-gas liquids.
Allen	9,326,720	7,720,339	Petroleum, natural gas.
Ascension	813,275	1,256,907	Petroleum, natural gas, salt.
Assumption	15,464,576	16,892,480	Petroleum, natural gas.
Avoyelles	2,324,286	2,069,976	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Beauregard	15,470,119	16,654,220	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Bienville	5,992,690	6,563,730	Natural gas, petroleum, clays.
Bossier	32,369,346	26,584,677	Natural gas, petroleum, natural-gas liquids, sand and gravel.
Caddo	36,179,692	33,759,568	Petroleum, natural gas, natural-gas liquids, sand and gravel, clays.
Calcasieu	42,357,529	40,380,574	Petroleum, natural gas, natural-gas liquids, cement, sulfur, lime, salt.
Caldwell	358,614	312,719	Natural gas, petroleum.
Cameron	75,536,028	86,486,152	Petroleum, natural gas, natural-gas liquids, salt.
Catahoula	3,512,383	3,979,715	Petroleum, sand and gravel, natural gas.
Claiborne	28,141,638	24,472,128	Petroleum, natural gas, natural-gas liquids.
Concordia	15,047,483	14,698,106	Petroleum, natural gas, natural-gas liquids, sand and gravel.
De Soto	11,199,765	10,536,310	Natural gas, petroleum, natural-gas liquids.
East Baton Rouge	14,295,709	12,087,018	Cement, petroleum, sand and gravel, natural gas, natural-gas liquids, clays.
East Feliciana	(3)	(3)	Sand and gravel.
Evangeline	11,933,699	10,973,554	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Franklin	2,517,965	2,762,866	Petroleum, natural gas.
Grant	932,210	1,080,060	Sand and gravel, petroleum.
Iberia	60,568,374	66,803,620	Petroleum, salt, natural gas, clays, sand and gravel.
Iberville	24,088,421	24,594,371	Petroleum, natural gas, salt, sand and gravel.
Jackson	32,771	27,882	Natural gas.
Jefferson	46,809,837	56,356,662	Petroleum, natural gas, natural-gas liquids, shell.
Jefferson Davis	34,951,024	37,190,913	Natural gas, petroleum, sand and gravel, natural-gas liquids.
Lafayette	2,916,844	4,280,236	Petroleum, natural gas, clays.
Lafourche	134,501,573	150,613,225	Petroleum, natural gas, sulfur.
La Salle	15,353,437	16,650,787	Petroleum, natural gas, sand and gravel.
Lincoln	21,974,662	18,884,115	Natural-gas liquids, natural gas, petroleum, bentonite, sand and gravel, clays.
Livingston	412,652	507,323	Petroleum, sand and gravel, natural gas.
Madison	1,283,086	1,312,945	Petroleum, natural gas.
Morehouse	1,654,706	1,344,057	Natural gas, petroleum.
Natchitoches	351,942	332,397	Petroleum, clays, natural gas.
Orleans	9,361,115	9,130,161	Cement, shell.
Ouachita	4,321,389	6,388,520	Natural gas, sand and gravel, petroleum clays.
Plaquemines	304,713,310	347,377,053	Petroleum, sulfur, natural gas, natural-gas liquids.
Pointe Coupee	6,857,906	7,392,081	Petroleum, natural gas, natural-gas liquids, clays, sand and gravel.
Rapides	3,244,411	2,280,261	Sand and gravel, petroleum, clays, natural gas.
Red River	898,474	896,954	Petroleum, natural gas, sand and gravel.
Richland	16,263,457	15,877,538	Petroleum, natural-gas liquids, natural gas.
Sabine	603,998	506,798	Petroleum, natural gas.
St. Bernard	364,237	639,043	Do.
St. Charles	26,063,983	30,224,651	Petroleum, natural gas, natural-gas liquids.
St. Helena	535,852	(3)	Sand and gravel.
St. James	4,262,652	4,359,165	Petroleum, natural gas.
St. John the Baptist	592,383	2,504,692	Do.
St. Landry	35,872,957	35,278,059	Petroleum, natural gas, natural-gas liquids.
St. Martin	42,524,226	44,673,464	Petroleum, natural gas, salt, natural-gas liquids.
St. Mary	82,907,001	94,452,935	Petroleum, natural gas, natural gas liquids, shell.
St. Tammany	907,205	605,077	Sand and gravel, natural gas, petroleum, clays.
Tangipahoa	974,102	912,823	Sand and gravel, clays.
Tensas	10,711,063	12,231,195	Petroleum, natural gas, natural-gas liquids.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Louisiana, by parishes [1] [2]—Continued

Parish	1958	1959	Minerals produced in 1959 in order of value
Terrebonne [4]	$129,445,477	$156,885,401	Petroleum, natural gas, natural-gas liquids, sulfur.
Union	8,370,684	7,142,198	Natural gas, petroleum, sand and gravel.
Vermilion	60,895,663	61,235,607	Natural gas, petroleum, natural-gas liquids.
Washington	1,695,345	1,211,186	Sand and gravel, natural gas, petroleum.
Webster	35,019,953	31,598,615	Natural-gas liquids, petroleum, natural gas, sand and gravel.
West Baton Rouge	997,888	951,669	Petroleum, natural gas.
West Carroll	470,535	318,919	Natural gas.
West Feliciana	(3)	(3)	Sand and gravel.
Winn	1,956,845	1,889,327	Salt, gypsum, petroleum, natural gas.
Undistributed	7,253,845	[5] 16,246,199	
Total [6]	[7] 1,523,370,000	1,654,493,000	

[1] East Carroll and Vernon Parishes not listed because no production was reported.

[2] Value of petroleum, natural gas, and natural-gas liquids by parishes based on data from Louisiana Department of Conservation, Annual Oil and Gas Report, 1959.

[3] Figure withheld to avoid disclosing individual company confidential data; value included with 'Undistributed."

[4] Terrebonne Parish sulfur shipments included with Plaquemines Parish.

[5] Includes some shell, sand and gravel, salt and petroleum that cannot be assigned to specific parishes, and values indicated by footnote 3.

[6] Total has been adjusted to avoid duplicating value of clays and stone.

[7] Revised figure.

Acadia.—Exploratory drilling of 41 wells for petroleum and natural gas proved 37 percent productive, and of 74 development wells drilled 81 percent were productive. The parish ranked first in production of natural-gas liquids, with an output valued at more than $13 million. Texas Natural Gasoline Corp., Rayne, completed its new Toca plant No. 12 at a cost of $11.5 million. The plant, designed to process 700 million cubic feet of raw gas daily to produce propane, butane, and natural gasoline, went on stream during January 1959. LaGloria Oil & Gas Co. completed a new absorption-type gas-processing plant at a cost of $4 million.

Ascension.—The Burnside Bulk Terminal, completed in 1958, unloaded bauxite from South America for the Ormet Corp. and loaded alumina onto barges for shipment up the Mississippi and Ohio Rivers. The terminal also was used to transfer foreign iron ore from ocean ships to barges for shipment to steel mills in the St. Louis and Chicago areas. Wyandotte Chemical Corp.'s Geismar plant completed the first unit of its caustic soda and chlorine plant (150-ton-a-day) early in 1959. The second 150-ton-a-day unit was completed a few months later. Petroleum and natural gas were produced in the parish during the year.

Beauregard.—Exploratory drilling resulted in the discovery of the Skinner Lakes oilfield.

Bossier.—Sunray Mid-Continent Oil Co. was expanding propane-recovery facilities. Natural gas, crude petroleum, natural-gas liquids, and sand and gravel, in order of value, were produced.

Caddo.—The parish continued to rank first in the total number of oil and gas wells drilled—437 wells in 1959 (396 in 1958). Exploratory drilling resulted in the discovery of Missionary Lake oilfield. Caddo Light Aggregate Co., Inc., a subsidiary of Bayou State Oil Corp., completed a lightweight aggregate plant northwest of Shreveport. The company mined clay from a nearby open pit for the raw material. Crude petroleum, natural gas, natural-gas liquids, sand

and gravel, and clays, in the order of value, were produced in the parish.

Calcasieu.—Lake Charles Industrial Complex, comprising over a dozen large plants, built to facilitate production and processing of crude petroleum, natural gas, natural-gas liquids, cement, sulfur, lime, and salt, was one of the most important producers in the State. Gulf States Utilities Co., West Lake, completed the first 111,000-kw. unit of its Roy S. Nelson Station in February and a second 111,000-kw. unit in June 1959. A third unit of 162,000-kw. capacity was scheduled for completion in April 1960. (The capacity of 2 million kw. reported on page 435 of the 1958 Minerals Yearbook, Volume III, was in error.) The company will have a combined capacity of 1,339,000 kw. from its four powerplants, of which two are in the Lake Charles area and one each in the Baton Rouge, La., and Sabine, Tex., areas.

Continental Oil Co. completed a $3 million catalytic re-forming unit at its Lake Charles refinery. The company began constructing a plant to manufacture petroleum-derived industrial alcohols, which formerly were produced only from natural fats and oils. Capacity of straight-chain primary alcohols will be more than 50 million pounds a year. Hercules Powder Co. was building a new $16 million plant with a capacity of more than 100 million pounds a year of polypropylene. Olin-Mathieson Chemical Corp. completed new facilities at its ammonia plant at a cost of $214,000. Firestone Tire & Rubber Co. completed additions to its synthetic rubber plant at a cost of $1.7 million. The original capacity of 60,000 long tons of synthetic rubber a year (1943) was expanded to 190,000 long tons a year in 1959. Columbia-Southern Chemical Corp. was constructing an ethylene dichloride plant adjoining the firm's chlorine and caustic soda manufacturing facilities. Falcon Chemical Corp. completed a new plant to produce industrial-grade methanol and furfural. Exploratory drilling resulted in the discovery of the Hickory Branch and Lake Charles gasfields.

Cameron.—The parish ranked fifth in total value of mineral production and first in value of natural gas output. Exploratory drilling led to the discovery of the Little Cheniere Ridge oilfields and the South Creole, Lacassine Refuge, High Island, and North Sabine Lake gasfields.

Catahoula.—Exploratory drilling in the parish resulted in the discovery of the Enterprise, Prichard, South Prichard, and Long Branch oilfields.

Claiborne.—Iron ore resources in the parish investigated by the Louisiana Geological Survey during the year, indicated similarity in character and occurrence to the iron ore being mined in east Texas. The investigations were to be continued in surrounding parishes in 1960. Petroleum, natural gas, and natural-gas liquids were produced.

Concordia.—Three oilfields, the North Horseshoe, Monterey, and South Monterey, were discovered during the year. Petroleum, natural gas, natural-gas liquids, and sand and gravel were produced in the parish.

De Soto.—Drilling for petroleum and natural gas in De Soto Parish was stepped up during the year. The total of 176 holes drilled (169 holes in 1958) was fourth highest in the State. Ten Mile Bayou oilfield was discovered.

East Baton Rouge.—Construction of new facilities and expansion of existing facilities highlighted the Baton Rouge area, which is one of the State's largest industrial regions. Kaiser Aluminum & Chemical Co. processed Jamaican bauxite into alumina at its North Baton Rouge plant. Polymer Chemicals Division, W. R. Grace & Co., had completed construction of a new $20 million plant to produce high-density polyethylene plastic in 1958 and, in 1959, completed additional facilities at a cost of $1 million. Esso Standard, a division of Humble Oil & Refining Co. was increasing fluid catalytic cracking, fresh-feed capacity, and recycling capacity. The company also announced plans for a $16 million expansion of production facilities for butyl rubber. Plant modifications and expansions were expected to add 20,000 long tons of capacity by mid-1960 and another 18,000 long tons in 1961. The total would then reach more than 135,000 long tons a year.

Allied Chemical Corp., Solvay Process Division, completed additions to its alkalies, chlorine, and other chemical facilities. Ethyl Corp. completed additions to its plant for producing gasoline antiknock compounds, vinyl chloride monomer, and other chemicals. Copolymer Rubber & Chemical Corp. completed plant additions in 1959 and immediately announced plans for further expansion. The new facilities would increase the company's rubber capacity to 125,000 long tons. Clay was mined by Acme Brick Co. for making brick. Ideal Cement Co. produced portland, high-early strength, and masonry cements from shell that was barged up the Mississippi River.

Franklin.—Exploratory drilling resulted in the discovery of Winnsboro gasfield. Petroleum and natural gas were produced in the parish.

Iberia.—The parish ranked first in the State in salt production; over a third of the output came from three large mines. Crude oil, natural gas, clays, and sand and gravel also were produced. Two of the four offshore gasfields discovered in 1959 were in Iberia Parish. They were Eugene Island, Block 4, and Eugene Island, Block 8.

Jefferson.—Freeport Sulphur Co. at yearend was nearing completion of its Grand Isle mining project—the first offshore sulfur mine. Petroleum valued at $52 million was produced in Jefferson Parish, which ranked fifth in the State. American Cyanamid Co. completed additions to its Fortier plant to produce 50 million pounds annually of acrylonitrile. Natural gas, natural-gas liquids, and shell also were produced in the parish.

Lafourche.—The parish ranked third in the total value of minerals produced, second in crude oil output and fifth in natural gas production in the State. Exploratory drilling resulted in the discovery of Bayou Ferblanc and Southwest Lake Boeuef oilfields and Bayou Chevruil gasfield. Freeport Sulphur Co. mined sulfur by the Frasch process at its Chacahoula mine.

LaSalle.—Petroleum, natural gas, and sand and gravel were produced in the parish. Exploratory drilling resulted in the discovery of the West Trout Creek and West Saline Lake oilfields.

Lincoln.—The parish continued to rank third in the State in the production of natural-gas liquids, which were valued at nearly $10 million. Filtrol Corp. mined bentonite to be used for filtering and bleaching.

Orleans.—To keep pace with the industrial expansion in the New Orleans metropolitan area, the New Orleans Public Service, Inc., started constructing a new 230,000-kw. unit at its Michoud Station. The installation, estimated to cost over $24 million, was scheduled for operation in the spring of 1963. Cement and shell were produced in the parish. Most of the barite ground in the State was from imported ores and was processed in Orleans Parish by three companies. Crude perlite from the Western States was used by Alatex Construction Service, Inc., to expand perlite for use in acoustical plasters and concrete aggregate.

Ouachita.—Natural gas, sand and gravel, petroleum, and clays, in order of value, were produced in the parish. Exploratory drilling resulted in the discovery of the Cheniere Brake and Cheniere Creek gasfields.

Plaquemines.—The total value of mineral production in the parish, which is situated in the Mississippi River Delta, increased from $305 million in 1958 to $347 million in 1959—the highest in the State. The parish ranked first in the production of crude petroleum and sulfur and fourth in that of natural gas. Geophysical prospecting continued throughout the year. Exploratory drilling resulted in the discovery of the Buras and Empire oilfields onshore and the Main Pass, Block 12, gasfield, offshore. The parish had large onshore and offshore reserves of petroleum and natural gas. Timcoat Corp. constructed a new plant at a cost of $1.5 million and began producing rubberized asphalt mastic for marine pipeline coating.

Rapides.—Clay was mined for making lightweight aggregate by Louisiana Lightweight Aggregate Co. and for structural clay products by Acme Brick Co. Seven commercial sand and gravel producers (one more than in 1958) operated in the parish. Paving gravel was produced by contract for the National Forest Service. Crude petroleum and natural gas also were produced.

Red River.—Petroleum, natural gas, and sand and gravel were produced. Exploratory drilling resulted in the discovery of the Williams gasfield.

Richland.—Petroleum, natural-gas liquids, and natural gas, in order of value, were produced. Exploratory drilling led to the discovery of the Mangham oilfield.

St. James.—Kaiser Aluminum & Chemical Corp. completed its new $70 million alumina plant at Gramercy and started production in May. The plant, on the east bank of the Mississippi River halfway between New Orleans and Baton Rouge, has an annual capacity of 430,000 tons of alumina. Production of both crude petroleum and natural gas increased in 1959.

St. John the Baptist.—Exploratory drilling led to the discovery of the Wallace gasfield. Petroleum and natural gas were produced.

St. Landry.—The parish ranked fourth in the recovery of natural-gas liquids. Petroleum and natural gas also were produced. Exploratory drilling led to the discovery of the Pecaniere gasfield.

St. Martin.—Petroleum, natural gas, salt, and natural-gas liquids, in order of value, were produced. Exploratory drilling led to the discovery of the Bayou LaRose gasfield.

St. Mary.—The parish continued to rank fourth in the State in total value of minerals and fourth in petroleum production. Natural gas, natural-gas liquids, and shell also were produced.

Central Louisiana Electric Cooperative (CLECO) completed a gasoline plant 5 miles east of Jeanerette to process 25 million cubic feet of natural gas a day for extraction of natural gasoline, butane, and propane. Geophysical prospecting was very active during the year.

Tangipahoa.—Sand and gravel and miscellaneous clay were produced.

Tensas.—Petroleum, natural gas, and natural-gas liquids were produced.

Terrebonne.—The parish ranked second in total value of minerals produced, second in natural gas production, second in the number of wells drilled for exploration and development of petroleum and natural gas, and third in oil production in the State. Exploratory drilling, onshore, resulted in the discovery of the Bayou Chauvin gasfield. Freeport Sulphur Co. closed its Bay Ste. Elaine sulfur operation in December, owing to depletion of reserves. The mining barge, containing the boilers, pumps, and other mining equipment, used at Bay Ste. Elaine for 7 years, was towed to Lake Pelto, where an artificial island was constructed to house mining facilities. The mining barge was being rehabilitated. Offices, living quarters, and recreation facilities were being constructed. Production was scheduled to start in the fall of 1960.

Tidewater Oil Co. let a contract to build a 75-million-cubic-feet-a-day gasoline plant in the Hollywood-Houma gasfields. The low-temperature absorption process was to be used.

Union.—Development drillers achieved the remarkable record of completing 46 gas-producing wells and no dry holes in 1959.

Vermilion.—The parish continued to rank third in the value of natural gas output and fifth in that of natural-gas liquids in the State. Exploratory drilling discovered the Esther and Redfish Point gasfields and the Parcperdue oilfield, all onshore, and the Vermilion, Block 104, gasfield offshore. All were gaged to have a high potential for producing natural gas and petroleum.

Webster.—The parish ranked second in the value of natural-gas liquids recovered. Petroleum, natural gas, and sand and gravel also were produced.

Winn.—Exploratory drilling resulted in the discovery of the Colgrade oilfield. Salt, gypsum, petroleum, and natural gas, in order of value, were produced.

The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Maine.

By Robert W. Metcalf[1] and Mary E. Otte[2]

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THE VALUE of mineral output in Maine in 1959 rose to $13.3 million, 6 percent over 1958 and 2 percent above the highest recent year, 1955. Production of portland cement, clays, stone (except limestone), sand and gravel, and mica all increased, responding to augmented demand for their use in road construction. The closing of the only lime-producing plant accounted for the decrease in limestone output. Feldspar mining continued to decline. A new discovery of cesium was claimed in Oxford County.

Nearly 4.5 million acres of Maine's potential mineral areas was studied and mapped in field and air reconnaissance by university, Federal, and State geologists. Many private mining and exploration companies also were evaluating possible commercial deposits of metals and industrial minerals. The Geological Survey of Maine began a compilation of the mineral resources and occurrences of the State.

Legislation and Government Programs.—Beryl and mica were purchased for the strategic minerals stockpile through the General Services Administration (GSA) purchase depots at Franklin, N.H. (beryl and mica), and Spruce Pine, N.C. (mica).

TABLE 1.—Mineral production in Maine[1]

Minerals	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrates..........gross weight..	(2)	(2)	3	$2
Clays....................................	23,270	$26	25,104	26
Feldspar..............................long tons..	13,034	83	(2)	(2)
Gem stones..............................	(3)	5	(3)	10
Mica:				
Scrap....................................	104	3	157	4
Sheet..............................pounds..	20,097	278	22,360	237
Sand and gravel..........thousand short tons..	8,942	3,746	9,452	3,644
Stone.................................do....	880	2,760	819	2,766
Value of items that cannot be disclosed: Cement (masonry and portland), lime (1958), peat, and values indicated by footnote 2......	....	6,363	....	7,050
Total Maine[4]............................	....	12,574	....	13,278

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Weight not recorded.

[4] Total has been adjusted to eliminate duplicating the value of stone.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

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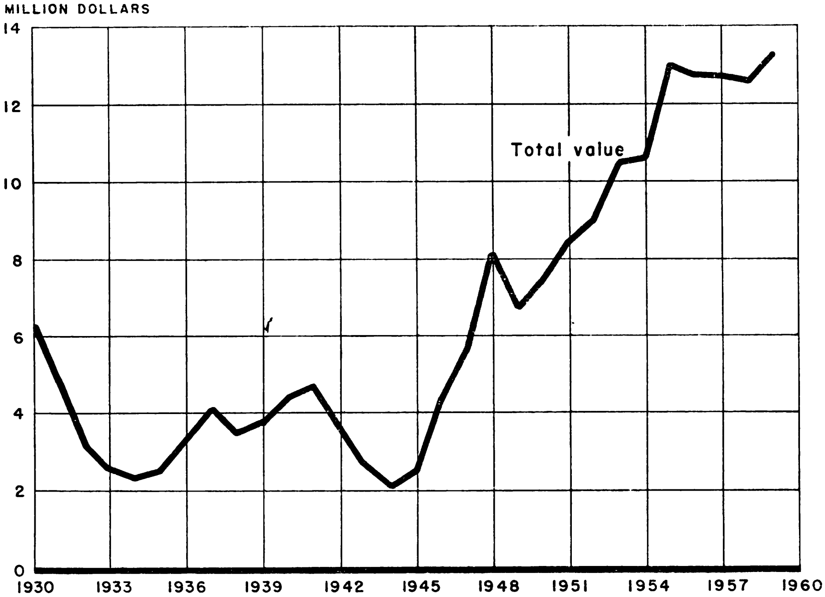

FIGURE 1.—Total value of mineral production in Maine, 1930–59.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—In spite of a 2-month shutdown, output of portland cement rose 9 percent over 1958, owing to increased building and road construction. The average value per barrel rose 3 percent to $3.50 from $3.40 in 1958. A 5-percent wage increase was granted on May 1. The only operating plant in Maine, Dragon Cement Co., a division of American-Marietta Co., marketed general-use, moderate-heat, and some high-early-strength cement from its 2-million-barrel wet-process mill at Thomaston, Knox County. Output of masonry cement increased 25 percent over 1958. Both masonry and portland cement were shipped to New England States, the larger part going to Maine and Massachusetts. Most of the cement was shipped by railroad in paper bags. The three largest classifications of portland cement consumers were: Ready-mixed concrete companies, building-material dealers, and Government agencies.

Clays.—Output of clay increased 8 percent compared with 1958 and consisted entirely of miscellaneous clay consumed in the manufacturing of structural clay products, mostly building brick. Seven clay pits were active, the producers also making brick in nearby plants—two were in Androscoggin County, four in Cumberland, and one in Franklin County. The chief producers were Morin Brick Co., Androscoggin County, and LaChance Bros. Brick Co., Cumberland County.

According to reports from producers, 88 men were employed in the clay-mining industry in Maine in 1959; these men worked 120,713 man-hours and had a total of eight injuries. The accident-frequency rate for this industry was 62.7 per million man-hours of exposure.

Feldspar.—Production of feldspar decreased to the lowest since 1945. Slackened ceramic demand was primarily responsible. Average value per ton dropped slightly ($6.31 in 1959 compared with $6.33 in 1958). Output was concentrated in Oxford and Sagadahoc Counties, with over 75 percent in Oxford County. Direct reports from producers and purchases by feldspar grinders indicated output from 4 mines in Oxford County and 12 in Sagadahoc.

Ground feldspar was sold by two firms, one at West Paris (Oxford County) and one at Topsham (Sagadahoc County). A plant at Topsham crushed feldspathic rock for use as poultry grit. Two of these firms purchased all their feldspar requirements. The ground feldspar was consumed largely for soaps and abrasives and for ceramic uses, including pottery, electrical porcelain, tile, and sanitary ware. Distribution was chiefly to the North Central States and Wisconsin; minor quantities went to other States.

Gem Stones.—The chief source of gem-quality stones and mineral specimens was Oxford County. Small quantities were collected from Cumberland County and unspecified locations. Included among these specimens were staurolite, beryl, rose quartz, tourmaline, amblygonite, and apatite. Other gem materials found in recent years in Androscoggin, Kennebec, and Oxford Counties included garnet (Androscoggin County); cancrinite, nephelite, sodalite, and zircon (Kennebec County), and agate, amethyst, aquamarine, smoky quartz, and spodumene (Oxford County).

Mica.—Output of both sheet and scrap mica increased over 1958. As in previous years, the greatest amount by far came from Oxford County and consisted of hand-cobbed and full-trim material sold entirely through the GSA purchase depots at Franklin, N.H., and Spruce Pine, N.C. A small quantity was produced in Sagadahoc County. Some punch and "other" mica was purchased by industry. Scrap mica was sold to mica grinders.

Nitrogen Compounds.—Anhydrous ammonia was manufactured at Searsport, Waldo County, for use in fertilizer.

Peat.—Peat moss was produced by two companies, one each in Hancock and Washington Counties. Output, which was more than double that of 1958, was utilized chiefly as a soil conditioner in agriculture.

Sand and Gravel.—Output of sand and gravel rose to a new record tonnage, totaling 9.5 million short tons, or 6 percent higher than in 1958, the next highest year. Although less commercial building gravel and fill-and-other gravel were produced than in 1958, output in other categories increased, including building and paving sand. Cumberland County produced the largest quantity of sand and gravel (nearly 1.7 million short tons), followed in order by Penobscot, Aroostook, Kennebec, and Androscoggin Counties. Forty-two percent of the commercial sand and gravel sold or used was marketed as washed, screened, or otherwise prepared material; the balance was sold as bank run.

Government-and-contractor tonnage comprised 84 percent of the total sand and gravel in both 1959 and 1958. The largest producer by

TABLE 2.—Sand and gravel sold or used by producers, by classes of operations and uses

	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Structural	233,023	$234,176	242,724	$239,117
Paving	105,402	46,783	164,958	110,442
Engine	(1)	(1)	3,191	4,628
Fill	64,799	22,995	98,644	31,404
Other	5,794	3,651	17,996	8,218
Gravel:				
Structural	236,447	261,736	175,722	213,121
Paving	536,097	336,403	563,029	333,898
Railroad ballast	38,790	11,978	19,815	6,935
Fill	138,472	72,478	234,603	105,334
Other	76,614	28,457	11,081	5,162
Undistributed [2]	1,160	1,502		
Total	1,436,598	1,020,159	1,531,763	1,058,259
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Structural	3,940	1,684	2,915	1,020
Paving	469,689	164,262	510,092	197,418
Other			12,960	4,536
Gravel:				
Structural	3,020	1,380	455	159
Paving	7,028,274	2,558,779	7,391,954	2,381,860
Other			2,279	798
Total	7,504,923	2,726,105	7,920,655	2,585,791
Grand total	8,941,521	3,746,264	9,452,418	3,644,050

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes filter sand and values indicated by footnote 1.

far was the Maine Highway Commission, which mined sand and gravel both with its own crews and under contract. Virtually all of the Government-and-contractor output was used for road construction and maintenance.

Stone.—Stone production dropped about 7 percent compared with 1958. This decline was due to a large decrease in output of limestone because of the closing in 1958 of the State's only lime plant at Rockland, Knox County. Other types of stone quarried—granite, sandstone, basalt, slate, and miscellaneous stone—had moderately higher outputs than in 1958. Fifteen commercial quarries were active in 8 counties: 6 for granite in 4 counties; 4 for limestone in 2 counties; 2 for quartzite in 2 counties; and 1 each for basalt, slate, and miscellaneous stone in 3 counties. Two types of stone were quarried in three counties. Of the granite quarries, three produced both dimension and crushed stone and the other three dimension stone only.

Production of dimension stone comprised granite and slate only. Granite dimension stone included rough and dressed construction and architectural stone, monumental stone, rubble, curbing and flagstone, and paving blocks. Slate dimension stone included electrical slate and flagging. Crushed and broken granite was used mostly as riprap; crushed quartzite, basalt, and miscellaneous stone were used principally as roadstone; and crushed and broken limestone was consumed in manufacturing cement, for road construction, for agricultural use, and in papermaking. Slate was quarried only in Piscataquis County; production increased 6 percent in quantity and 35 percent in value over 1958. The increase in value was due primarily to the larger proportion of the higher priced electrical slate sold in 1959. The chief stone-producing counties, in order of quantity, were Knox, Cumberland, and Washington and, in order of value, Knox, Cumberland, and York.

TABLE 3.—Value of mineral production in Maine, by counties

County	1958	1959	Mineral produced in 1959 in order of value
Androscoggin	$539,225	(1)	Sand and gravel, clays.
Aroostook	328,479	$405,685	Sand and gravel, stone.
Cumberland	880,911	1,061,125	Sand and gravel, stone, clays, gemstones.
Franklin	(1)	(1)	Sand and gravel, clays.
Hancock	(1)	(1)	Stone, sand and gravel, peat.
Kennebec	471,364	424,625	Sand and gravel, stone.
Knox	(1)	(1)	Cement, stone, sand and gravel.
Lincoln	103,638	70,812	Sand and gravel.
Oxford	463,622	(1)	Mica, sand and gravel, feldspar, beryl, gemstones.
Penobscot	572,132	523,114	Sand and gravel, stone.
Piscataquis	(1)	(1)	Stone, sand and gravel.
Sagadahoc	90,903	76,373	Sand and gravel, feldspar, mica, beryl.
Somerset	187,955	(1)	Sand and gravel.
Waldo	(1)	(1)	Sand and gravel, stone.
Washington	(1)	(1)	Stone, sand and gravel.
York	(1)	(1)	Stone, sand and gravel, peat.
Undistributed	8,935,835	10,716,690	
Total	12,574,000	13,278,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

According to reports from the producers, 501 men were employed in the stone industry in 1959. These men worked 972,731 man-hours. With 32 injuries, the frequency rate per million man-hours of exposure was 33.6.

METALS

Beryllium.—The output of beryl (beryllium concentrates) increased substantially in 1959. Four mines in Oxford County and one in Sagadahoc reported sales through the GSA purchase depot at Franklin, N.H. All the beryl, which averaged about 11.8 beryllium oxide, was purchased for the critical materials stockpile.

REVIEW BY COUNTIES

The Maine State Highway Commission produced paving sand and gravel in all counties of the State, both with its own crews and under contract; a small amount of building sand and gravel also was mined. In addition, Acadia National Park in Hancock County, five towns or municipalities in Androscoggin County, and one each in Hancock and Penobscot Counties mined sand and gravel for their own consumption in road and street maintenance. Maine Highway Commission contracted for a small quantity of miscellaneous stone for roadmaking in Kennebec and Penobscot Counties.

Androscoggin.—Ten sand and gravel producers were active; most of them were near Lisbon, Auburn, Lewiston, and Leeds Junction. Prepared sand and gravel for use as building and paving material and for fill comprised most of the output. Leading producers were G. A. Peterson Co., Lewiston Crushed Stone Co., and Leeds Sand & Gravel Co. The last-named firm has begun a long-term program of reforestation on worked-out land and is planting 1,200 white-pine year seedlings per acre (supplied by the State tree nursery). In addition to promoting community goodwill and making the land better looking, profit will be realized from sales of mature trees in future years.[3]

Miscellaneous clay was produced from open pits by two companies near Auburn for use in making building brick.

United States Gypsum Co. continued production of insulation board and other gypsum products at its plant in Lisbon Falls.

Aroostook.—Commercial sand and gravel was produced by three operators near Connor, Presque Isle, and Hodgdon. Most of the sand and gravel was unprepared and was sold for use chiefly as building and paving gravel and gravel for fill.

Cumberland.—Cumberland County was the leading sand and gravel producing county with an increase of 19 and 18 percent in tonnage and value, respectively, compared with 1958. Sand and gravel, mainly for building and paving, was produced in the county by nine producers, two more than in 1958. Leading producing areas were Portland, Scarborough, and Cumberland. Ninety-nine percent of the material was transported by truck.

Crushed miscellaneous stone for use as road material was produced by Cumberland Sand & Gravel Co., Cumberland.

Four producers mined clay—two from pits near Cumberland Center and one each near Gorham and North Yarmouth. The miscellaneous clay was crushed, ground, and screened for use in making building brick.

A small quantity of gem material (staurolite) was collected near South Windham.

Franklin.—Miscellaneous blue clay for manufacturing building brick was mined near West Farmington.

Omer Beisaw (Wilton) produced prepared paving sand, and building and paving sand and gravel. Thomas A. Skolfield (Weld) sold unwashed sand for use on roads and some gravel for fill.

Hancock.—Hancock County continued to lead in the production of granite with an increase of 2 percent in quantity and a decrease of 22 percent in value. Deer Island Granite Corp., Stonington, quarried dimension granite principally for dressed construction, rough and dressed architectural, and dressed monumental stone. The quarry had eight benches averaging 10 feet high and 50 feet wide.

Richland Peat Mines, Inc., recovered moss peat from bogs near Penobscot.

Unprepared paving gravel was recovered from the Blue Hill pit by T. W. Carlisle.

Kennebec.—H. E. Sargent, Inc., Farmingdale, quarried limestone and crushed the stone at a semiportable plant for use as road material. The Maine State Highway Commission produced crushed miscellaneous stone for concrete and roadstone.

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[3] Pit and Quarry, vol. 52, No. 6, December 1959, p. 35.

Four sand and gravel operators near Fayette, Waterville, Gardner, and Augusta produced building sand and gravel, paving gravel, and gravel for fill.

Knox.—Dragon Cement Co., a division of American-Marietta Co., quarried and crushed limestone for use in manufacturing cement at its two-kiln plant at Thomaston. General-use and moderate-heat portland cement made by the wet process, comprised the bulk of the output, although some high-early-strength cement also was produced. Although the plant was idle 2 months, production and value increased compared with 1958.

Although Knox County continued to lead in the production of stone in the State, tonnage and value dropped 15 and 17 percent, respectively, from 1958. Hocking Granite Industries, Inc., Clark Island, produced and sold dimension granite, mainly for use as dressed construction, curbing and flagging, dressed architectural, and irregular-shaped rough construction stone. Some crushed granite was also produced for riprap. The single-face quarry with an average height of 130 feet was operated by drilling and blasting, channel cutting, and jet piercing. Rockland-Rockport Lime Co., Rockland, produced crushed or broken limestone at a stationary plant for agricultural use, papermaking, and riprap. Knox Lime Co. mined and crushed limestone for use in papermaking at a quarry and plant near Union. Quartzite, produced at the Blue Rock quarry, Westbrook, was crushed for use as concrete aggregate, riprap, and railroad ballast. Bridge Construction Corp. quarried and crushed quartzite for use as concrete aggregate at the Sidney quarry.

After an extensive 3-year mapping and drilling program on a 400-acre lithium-bearing pegmatite deposit in Warren Township, Dow Chemical Co. let its development option lapse. The Roland F. Beers Co., Troy, N.Y., has negotiated a long-term lease on about 150 acres of State-owned land in the county to continue its exploration program outlining a nickel-copper prospect. Exploration in Knox County and several other areas of the State for more than a year has included diamond drilling, electromagnetic surveys, and detailed field mapping.

Prepared commercial sand and gravel for building and paving was recovered from a pit near Warren. Some of the material was sold to local government agencies.

Lincoln.—Howard R. Wright, Newcastle, sold and transported by truck screened commercial gravel, chiefly for use as building material and fill.

Oxford.—Total output of mica produced in the county was sold solely through the GSA (Franklin, N.H., and Spruce Pine, N.C.) purchase depots. Sales of hand-cobbed mica increased 11 percent in quantity and 10 percent in value over 1958. Sales of full-trim mica increased 12 percent in quantity but declined 22 percent in value. Twenty-four producers worked 18 mines at various locations in the county. The five mines yielding the largest tonnage of mica during the year were: Wardwell (Albany), Pechnik and Cliff (both at Norway), Hibbs (Hebron), and Wheeler (Gilead). Among the mica producers were Wheeler Brothers, who have been removing mica from a 400- by 75- by 50-foot hole in Wheeler Mountain, near Bethel.

A tunnel driven into the mountain has exposed other mica-bearing areas. A labor force, skilled in trimming and rifting the mica recovered from the mine, has been developed in Bethel. Sales are for the critical minerals stockpile and are made to a local Government agent.[4]

Feldspar was recovered by four operators of open pits: Bell Minerals Co., Perham mine, West Paris; R. C. Benson, Conant mine, Hebron (subleased from Bell Minerals Co.); William Pechnik, Pelletier mine, Norway; and Lester Wiley mine, Norway. Bell Minerals Co. ground feldspar for ceramic use, including electrical porcelain, tile, pottery, and sanitary ware; metal polish; soaps; and abrasives. Most of the ground feldspar was shipped to Ohio, Wisconsin, New Jersey, and Massachusetts; smaller quantities went to other States.

Beryllium concentrate (beryl) was processed by four operators: Donald E. Cross, Cross mine, Milton; William Pechnik, Kendall mine, North Lovell; P. E. L. Mining Co., Pelletier mine, North Norway; and Lester E. Wiley, Wardwell mine, Albany. Sales were to the GSA (Franklin, N.H.) purchase depot. Discovery of a large deposit of high-quality cesium in Oxford County was claimed by T. C. Mining Co., West Paris. This firm also produces mica.

Oxford County continued to be the main source of gem material and mineral specimens collected in the State by dealers for resale or jewelry manufacture and by individual collectors as a hobby. Gem materials, collected near Albany, Peru, North Rumford, Newry, Greenwood, Stoneham, and other places in the county, consisted of beryl, rose quartz, rose beryl, tourmaline, amblygonite, dickensonite, and apatite.

Two operators of stationary plants near Norway and Mexico produced unprepared sand and gravel for fill and gravel for building and paving material.

Penobscot.—Penobscot County again ranked second in output and value of sand and gravel, with five producers (two less than in 1958). Principal types of sand and gravel, recovered near Stillwater, Lincoln, and Orono, were for building and paving material and fill. The Maine State Highway Commission produced miscellaneous stone and crushed it for use as concrete and roadstone.

Piscataquis.—Portland-Monson Slate Co. operated the Nos. 2 and 4 underground slate mines, processing the slate for use as electrical products and flagging at the Monson finishing mill. The company completed the No. 2 mine shaft and drifts during the year. Development comprised 100 feet of shaft sinking and 400 feet of drifting. Demand for slate increased over 1958.

Unprepared gravel for paving material was recovered from a pit near Abbot.

Sagadahoc.—Twelve operators recovered feldspar from mines in central Sagadahoc County near Topsham and Georgetown. Leading producers were: Adolfo Ponziani, White's Service, James Russo, and Russell Garland. Consolidated Feldspar, a department of International Minerals & Chemical Corp., purchased and ground the feldspar produced in the county at its Topsham mill for use in making soaps and abrasives, pottery, and tile. Most of the material was shipped to Pennsylvania, Ohio, New York, Massachusetts, Connecticut, and Michigan; some was exported to England and Canada.

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[4] Engineering and Mining Journal, vol. 161, No. 2, February 1960, p. 220.

Punched mica, recovered from the Trott Cove mine near Woolwich by Earl Williams and Willard Titcomb, was sold to industry and full-trim material to the GSA (Franklin, N.H.) purchase depot.

Arthur Trusiani recovered beryllium concentrate (beryl) from the Georgetown mine and sold the beryl to the GSA (Franklin, N.H.) purchase depot.

Building and paving sand and gravel were sold from pits near Topsham and Bath.

Somerset.—Sand and gravel was processed near Smithfield for use as building material, paving sand, and gravel for fill. Unscreened building sand and paving gravel also were produced.

Waldo.—Grenci & Ellis, Inc., quarried dimension granite for use as curbing stone at its Mount Waldo quarry near Frankfort.

Northern Chemical Industries continued to manufacture anhydrous ammonia at its plant in Searsport.

Prepared sand and gravel for making concrete was produced near Jacksonville. McGeorges and Powder House pits near East Machias and Ellsworth, respectively, yielded gravel used unprepared as railroad ballast.

Washington.—Crushed basalt for concrete and roadstone on Government projects was produced by A. P. Wyman, Inc., Cutler.

Prepared sand and gravel for building material was recovered near Machias.

Moss peat was recovered from a bog near Jonesport by Maine Peat Moss, Inc. The plant, which had burned early in 1958 at a loss of $250,000, resumed operations in October.

York.—John Swenson Granite Co., Highpine, quarried dimension granite for dressed architectural and irregular-shaped rough construction stone. Crushed granite for riprap and road material also was produced.

Gravel, for use as building material and fill, was recovered near York and sold unprepared.

The Mineral Industry of Maryland

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Maryland Department of Geology, Mines, and Water Resources.

By James R. Kerr[1] and Mary E. Otte[2]

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THE VALUE of mineral production in Maryland in 1959 increased 17 percent to $53.5 million, establishing a new record. Output of all major mineral commodities increased, but those industries most closely allied to construction, such as cement, crushed stone, sand and gravel, and clays, increased most significantly. Cement output increased, and cement became the leading commodity in the State in terms of value of production.

Baltimore County, with a large production of stone, sand and gravel, and clays, led in value of mineral production, followed by the cement-producing counties of Washington and Carroll.

TABLE 1.—Mineral production in Maryland[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays[2]	604,175	$815	660,781	$944
Coal	837,738	3,161	842,427	3,188
Gem stones	(3)	2	(3)	2
Natural gas . . . million cubic feet	4,266	1,148	[4] 5,400	[4] 1,500
Sand and gravel	[5] 8,513,244	[5] 11,367	10,033,720	12,983
Stone	6,721,414	14,387	7,445,489	15,476
Value of items that cannot be disclosed: Ball clay, cement, lime, greensand marl, potassium salts, talc and soapstone		16,224		21,416
Total Maryland[6]		[5] 45,734		53,508

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes certain clays, value for which is included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Preliminary figure.
[5] Revised figure.
[6] Total adjusted to eliminate duplicating value of clays and stone.

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[2] Statistical clerk, Bureau of Mines, Region V. Pittsburgh, Pa.

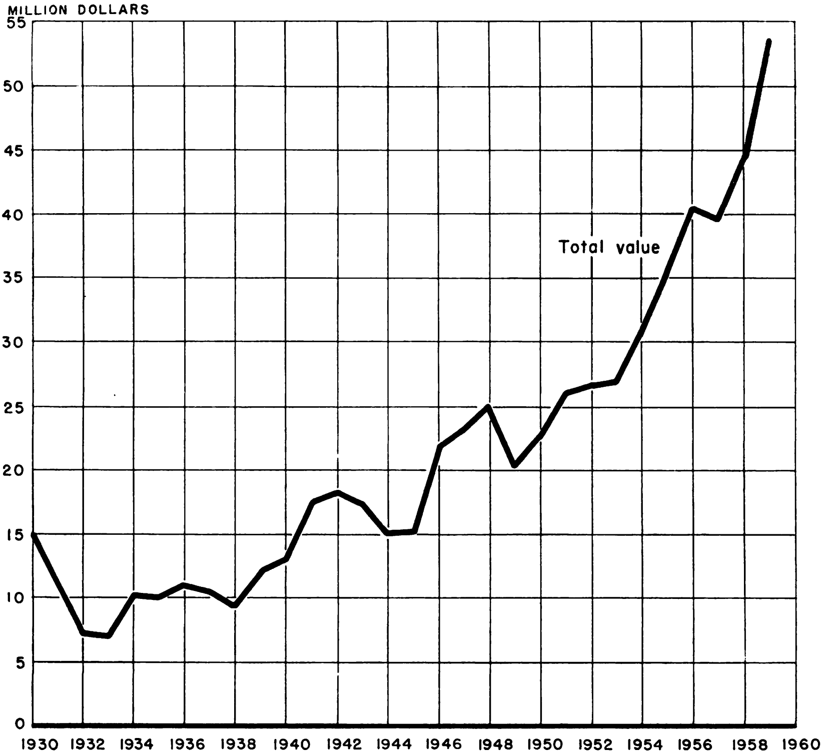

Figure 1.—Value of mineral production in Maryland, 1930–59.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland and masonry cement increased 28 percent, as companies operated at 75 percent of capacity compared with 60 percent in 1958. The bulk of production was non-air-entrained, general-use and moderate-heat types. Shipments, chiefly by rail in bulk, were mostly intrastate to ready-mix concrete companies, highway contractors, and concrete-product manufacturers. Substantial shipments also were made to neighboring Virginia, the District of Columbia, and West Virginia. Over 70 percent of State production was by the dry process. Power, except for a portion of self-generated power used by North American Cement Corp., was purchased.

The trucking industry won temporary permission to haul cement from the Alpha Portland Cement Co. Lime Kiln plant. The decision by a special three-judge court denied the railroad's request that trucking service be denied, pending a final decision by the Interstate Commerce Commission.

Clays.—Production of clays increased 9 percent as resurgent refractories and a steady construction consumed greater tonnages for firebrick, block, and building brick. The major portion of clay output in the State was miscellaneous clay for use by the construction industry, either as building brick or indirectly as an ingredient in manufacturing cement. Fire-clay production increased 22 percent, as heavy demand for refractories before the steel strike offset a depressed market late in the year. The market for ball clay changed significantly, as output for floor and wall tile was less than half that of the preceding year, but tonnages for refractories and pottery and stoneware more than trippled, resulting in an overall 9-percent increase in production.

Preliminary data indicated that an average of 239 men working 408,750 man-hours were employed by the clay industry in 1959. There were nine nonfatal lost-time injuries and one fatality during the year, resulting in a frequency rate of 24.5 injuries per million man-hours of exposure. Baltimore and Prince Georges remained the leading miscellaneous clay-producing counties, and Allegany County continued as the leading fire clay producing area. Ball clay was mined solely in Baltimore County.

Gem Stones.—Williamsite and picrolite were collected, chiefly by hobbyists, at scattered county locations.

Gypsum.—Wallboard and lath and base-coat plasters were manufactured from imported gypsum, calcined at a plant near Baltimore.

Iron Oxide Pigments.—A wide variety of finished iron oxide pigments, principally natural red iron oxide, burnt and raw umber, and manufactured red iron oxide, were produced.

Lime.—Production of lime increased 11 percent owing to renewed demand for agricultural lime. The industry, consisting of 35 pot kilns and 2 continuous hydrators operated by three companies in Frederick County, produced at a rate in excess of 55 percent of capacity.

Marl, Greensand.—A small tonnage of refined greensand marl was produced at Dunkirk in Calvert County for soil-conditioning purposes.

Perlite (Expanded).—Crude perlite from producers in New Mexico and Nevada was expanded at plants in Baltimore and near Washington, D.C., chiefly for use as building plasters, concrete aggregate, and filter aid. The product found a ready market, and production increased 20 percent over 1958.

Potassium Salts.—Production of potassium sulfate recovered as a byproduct of cement-mill operations in Washington County, decreased in 1959.

Sand and Gravel.—Total production of sand and gravel increased 18 percent. The average value per ton dropped $0.05 to $1.29. As in past years, the major portion of commercial output was for structures (49 percent) and paving (40 percent). Government-and-contractor production, which increased 75 percent, was almost entirely paving gravel. Total commercial sand production dropped slightly as decreased tonnage (24 percent) for paving more than offset a 23-percent increase in structural uses. Total gravel production, however, increased 34 percent owing chiefly to a 51-percent increase in use of paving gravel.

The percentage of total commercial production that was washed, screened, or otherwise prepared increased from 66 to 82 percent in 1959. All government-and-contractor production, however, was unprepared material. Because of its bulk and the low cost, most of the output was transported by truck to local consumers.

The industry employed 832 persons (743 production, 89 office) at 51 pits working 1,756,782 man-hours. Prince Georges, Baltimore, and Anne Arundel Counties led in commercial production. Significant government-and-contractor output was reported in Queen Annes and Worcester Counties. Other counties reporting government-and-contractor production were Talbot and Wicomico.

TABLE 2.—Sand and gravel sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Sand:				
Structural	1, 931, 713	$2, 475, 974	2, 375, 645	$3, 029, 827
Paving	2, 277, 026	2, 853, 199	1, 729, 610	2, 274, 240
Gravel:				
Structural	1, 817, 554	3, 488, 777	2, 198, 895	3, 703, 190
Paving	1, 349, 500	1, 661, 123	2, 042, 336	2, 717, 454
Undistributed [1]	1, 137, 451	888, 342	1, 687, 234	1, 258, 552
Total [2]	8, 513, 244	11, 367, 415	10, 033, 720	12, 983, 263

[1] Includes glass, grinding and polishing, fire or furnace, engine, filter (1958), fill, and other sands and gravel.
[2] Includes Government-and-contractor paving sand and gravel.

Stone.—Total production of stone increased 11 percent, directly proportional to the increase in crushed limestone production, which comprised 86 percent of the total stone tonnage. As in past years, crushed limestone was used mostly for concrete aggregate and roadbase material and as raw material for cement manufacture.

Production of crushed basalt for roadstone and concrete aggregate, crushed sandstone for refractory ganister and cement manufacture, and dimension marble and dimension miscellaneous stone was greater than in 1958. Production of dimension sandstone for rough construction, dressed building, and flagging was reported for the first time. Decreased output was noted for dimension granite, oystershell, crushed marble, and miscellaneous stone.

The industry employed an average of 1,132 men working 2,665,994 man-hours in 1959, according to preliminary figures. There were 53 nonfatal lost-time injuries resulting in a frequency rate of 19.9 per million man-hours of exposure.

The leading stone-producing counties in order of decreasing production were Baltimore, Washington, Frederick, and Carroll.

Talc and Soapstone.—Production of talc and soapstone increased 28 percent. A major portion of the crude output was ground and sold for asphalt filler, roofing, and miscellaneous uses. A small tonnage of crude material was sold directly to consumers in Ohio, Michigan, and New Jersey for use in foundry facings.

Vermiculite, Exfoliated.—Crude vermiculite was exfoliated at a plant in Beaver Heights, Prince Georges County.

MINERAL FUELS

Coal.—Production was slightly higher than in 1958. Output from Allegany County increased 25 percent due to greater strip-mining activity and offset a 7-percent production drop in Garrett County, where underground mining decreased sharply. Strip mining comprised 65 percent of the State total, and underground mining, 35 percent. Average price for strip production was $3.30 per ton, compared with $4.67 for underground. Average value of total production was virtually unchanged at $3.78 per ton. Most output was marketed locally for heating and power.

As in past years, coal mining in the State was characterized by small, nonmechanized underground mines and contour strip mines on the hillsides. However, 81 percent of underground production was cut by machine; 78 percent, power drilled; and 43 percent, hand loaded onto face or room conveyors. There was no mechanical cleaning in the county, but 40 percent of the total output was crushed and sized.

Coke and Coal Chemicals.—Bethlehem Steel Corp. produced 2,402,312 tons of coke at its Sparrows Point plant of 758 ovens, a decrease of 17 percent from 1958. Associated coproducts yielded were coke breeze, 150,078 tons; coke oven gas, 35,043 million cubic feet; ammonium sulfate 27,161 tons; tar, 29 million gallons; and crude light oil, 11 million gallons. Light-oil derivatives included benzene, 8 million gallons; toluene, 2 million gallons; and xylene, 408,716 gallons.

Natural Gas.—Increased output of natural gas was reported by producers in the Mountain Lake Park field and the Accident field in Garrett County.

METALS

Iron and Steel.—The annual capacity of Maryland's steel industry, mainly at the Sparrows Point plant, was 8,380,960 tons at yearend. Blast furnace capacity was 5,480,000 tons.

Iron and Steel Scrap.—Large tonnages of iron and steel scrap, mostly Nos. 1 and 2 heavy melting and No. 1 electric furnace bundles, were collected and prepared for additions to open-hearth and electric steel furnaces. Output was concentrated in the Baltimore area.

Refractory Metals.—E. I. duPont de Nemours & Co. announced construction plans for a metallurgical research center in the Curtis Bay section of Baltimore, where the company had produced titanium dioxide white pigment since 1931. The facility will contain equipment to forge, extrude, roll, draw, and heat treat such refractory metals as columbium, tantalum, titanium, zirconium, tungsten, and chromium, which have strategic uses in high temperature and nuclear applications.

REVIEW BY COUNTIES

Allegany.—Coal production increased 25 percent, chiefly due to a 45-percent increase in strip-mine output. The number of strip mines increased by 7 to 19. Although six more underground mines were active than in 1958, underground production remained virtually the same. Central Sand & Gravel Co. closed its No. 11 underground coal mine in October but opened a new mine (No. 5) the next month. Significant among the new coal producers in the county were the Mountain Top Coal Co. mine and the Bakerstown No. 6 mine of W & W Coal Co., both underground mines; and the strip mines of Allegany Engineering Co. and the George Coal Co. Production came mostly from the Pittsburgh and Bakerstown seams.

Production and value of sand and gravel increased 9 and 14 percent, respectively, during the year. The Cumberland Cement & Supply Co., quartzite No. 1 plant near Cumberland produced chiefly glass, building, grinding, and polishing sands; and its No. 3 plant on a sand-and-gravel island near Cumberland produced washed and screened structural and paving sand and gravel.

Fry Coal & Stone Co. operated three limestone quarries near Corrigansville, Flintstone, and Cumberland and produced crushed stone for use as concrete aggregate and roadstone.

Kaiser Refractories & Chemical Division, Kaiser Aluminum & Chemicals Corp. (formerly Big Savage Refractories, Division of Mexico Refractories Co.) operated an underground mine and an open-pit clay mine near Frostburg and produced plastic and flint fire clay for firebrick and block. Activity at the underground mine was curtailed for 5 months because of the steel strike. Mt. Savage Refractories Co. produced plastic fire clay at the Big Savage strip pit and flint fire clay at the Barrelville underground mine, both near Mount Savage, for refractory firebrick and block.

Anne Arundel.—Sand and gravel output increased considerably, but the county remained third in production and value in 1959. Sand and gravel, produced at five operations near Hanover, North Linthicum, Pasadena, and Davidsonville, was chiefly prepared for building and paving sand and gravel, fire or furnace sand, and unprepared fill gravel.

Severn Clay Co. (Glen Burnie) mined stoneware clay for floor and wall tile and sanitary ware.

Baltimore and Baltimore City.—The county continued to rank first in production and value among the 22 mineral-producing counties in

TABLE 3.—Value of mineral production in Maryland, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Allegany	$2,007,991	$2,252,752	Coal, sand and gravel, stone, clays.
Anne Arundel	1,226,381	(2)	Sand and gravel, clays.
Baltimore	10,525,737	11,749,123	Stone, sand and gravel, clays.
Calvert	(2)	(2)	Greensand marl.
Caroline	------------	101,726	Sand and gravel.
Carroll	7,452,559	8,249,300	Cement, stone, soapstone.
Cecil	946,246	969,331	Sand and gravel, stone, clays, gem stone.
Charles	49,645	50,000	Sand and gravel.
Dorchester	(2)	(2)	Sand and gravel, stone.
Frederick	(2)	7,435,241	Cement, stone, lime, clays.
Garrett	3,670,763	3,928,448	Coal, natural gas, stone, sand and gravel.
Harford	1,341,736	1,092,169	Sand and gravel, stone, soapstone.
Howard	(2)	------------	
Kent	(2)	83,342	Sand and gravel, clays.
Montgomery	148,757	92,904	Stone.
Prince Georges	[3] 4,704,804	5,989,109	Sand and gravel, clays.
Queen Annes	------------	168,364	Sand and gravel.
St. Marys	(2)	(2)	Do.
Talbot	28,495	(2)	Sand and gravel, clays.
Washington	(2)	(2)	Cement, stone, clays, potassium salts.
Wicomico	(2)	(2)	Sand and gravel, clays.
Worcester	59,760	38,323	Sand and gravel.
Undistributed [4]	13,571,692	11,308,118	
Total [5]	[3] 45,734,566	53,508,250	

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[1] Somerset County is not listed because no production was reported.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Revised figure.
[4] Includes values indicated by footnote 3 and gem stone unspecified by counties.
[5] Excludes values of clays and stone used in manufacturing lime and cement.

the State as value of mineral output increased 12 percent. Stone was the leading mineral produced, comprising one-half of the total value of county output.

Crushed limestone for road material was produced by Arundel Corp. at Greenspring. Harry T. Campbell Sons Corp. quarried limestone near Texas and east of Marriottsville in Baltimore County, crushing output for concrete aggregate, roadstone, paint and rubber filler, agriculture, railroad ballast, and other uses. Basalt, crushed chiefly for road material, was produced by The J. E. Baker Co. at the Blue Mount quarry near White Hall; The Arundel Corp., Baltimore City; and The Dooley Stone Co. near Hyde.

Dimension quartzite for dressed or cut architectural stone, irregular-shaped rough construction, and flagging, plus crushed quartzite for riprap, were quarried by The C. E. Weaver Stone Co., Butler, for the first year. Harry T. Campbell Sons Corp., Butler, quarried dimension granite for irregular-shaped construction stone, rubble, dressed construction stone, and flagging. Miscellaneous stone (serpentine) was quarried near Reisterstown and crushed for use as road material. Crushed, screened, and sized oystershell was produced near Baltimore for poultry grit and lime.

Baltimore County again ranked second in production of sand and gravel in the State; production increased 16 percent at six sand and gravel operations—most near White Marsh, Overlea, and Baltimore. Building and paving material plus screened bank-run sand for concrete block were produced. Seventy-five men were employed by the sand and gravel industry in the county and worked an average of 286 days.

The county remained the leading clay-producing area, as total value of clay production increased 7 percent. The only ball clay mined in the State was recovered from an open pit near Baltimore and was processed for making stoneware, art pottery and flowerpots, floor and wall tile, and refractories. Miscellaneous clay was mined at four open pits, all near Baltimore, by three companies for production of firebrick and block at local plants.

Calvert.—Kaylorite Corp. (Dunkirk), the only greensand marl producer in the State, sold its output for use as soil conditioner.

Caroline.—Cook & Son, Greensboro, produced and processed mostly structural sand, sand for fill, and a quantity of other sand and gravel for road maintenance. A portion of output was sold to local government agencies for road construction and maintenance.

Carroll.—Value of mineral production in the county, third-ranked mineral-producing area in the State, increased 10 percent. Shipments of cement increased slightly, and the county continued to lead in the State in value of cement output. Lehigh Portland Cement Co., Union Bridge, produced crushed sandstone and limestone for manufacturing cement. The company also produced general-use and moderate-heat, and high-early-strength portland cements and masonry cement by the dry process at its three-kiln plant. Most of the cement was shipped in bulk to ready-mix concrete companies. Shipments were largely intrastate, but significant quantities also were shipped to neighboring Virginia, District of Columbia, and Pennsylvania.

Teeter Sons, Inc. (Medford) quarried and crushed limestone for road-base material. Harry T. Campbell Sons' Corp., Towson, acquired the facilities of this company during the year. The new subsidiary will operate as Teeter Stone, Inc.

Soapstone was mined at the Marriottsville open pit by Liberty Stone Co. Some of the crushed material was transferred to the company Sykesville plant for further processing, chiefly for use as an asphalt filler. Other uses included roofing, foundry facings, and rubber filler.

Cecil.—Sand and gravel tonnage and value increased considerably. Output of seven sand and gravel pits near Rising Sun, Perryville, North East, Port Deposit, and Elkton was chiefly for building and paving.

Harbison-Walker Refractories Co. manufactured silica brick from quartzite quarried and crushed at the Leslie operation near North East. Port Deposit Quarries Co., Inc., quarried dimension granite for irregular-shaped construction stone, rough architectural stone, and rubble.

Plastic fire clay and some white clay was recovered from two open-pit mines near North East for manufacturing refractory firebrick and block.

Gem-stone hobbyists recovered williamsite near Conowingo and at the Chrome Pits mine.

Charles.—Paving sand and structural gravel were produced at a stationary plant near La Plata by A. D. Gamble & Son. Transportation to consumers was entirely by truck.

Dorchester.—Production of washed and pit-run sand and gravel, chiefly for building and paving, was reported by J. Edward Rosser, Inc., from a pit near Federalsburg. Bank-run material was sold to a local government agency for road construction.

J. M. Clayton, Cambridge, produced crushed oystershell for use as poultry grit and lime. Production was reduced as demand slackened.

Frederick.—Continued full-scale operation of the new cement plant of Alpha Portland Cement Co. (Lime Kiln) greatly increased shipments of cement in the county. Types I, II, and III air-entrained and non-air-entrained portland cements and some mortar cement were produced by the wet process. Captive cement rock was fed to two 400- by 11.4-foot rotary kilns. Output was shipped in bulk to ready-mix concrete companies and highway contractors. Most of the material was consumed in the State, but large quantities were shipped to Virginia, District of Columbia, and West Virginia.

Production and value of limestone and cement rock increased over the previous year. Six active operators near LeGore, Woodsboro, Lime Kiln, New London, Middletown, and Frederick crushed output at local plants, chiefly for concrete aggregate, roadstone, lime and cement manufacture, railroad ballast, and stone sand. M. J. Grove Lime Co. at Lime Kiln celebrated its centennial in 1959.

S. W. Barrick & Sons., Inc. (Woodsboro), LeGore Lime Co. (LeGore), and Everett V. Moser (Middletown) produced quick and hydrated lime for agriculture.

Hudson Supply & Equipment Co. mined miscellaneous clay for building brick at open pits near Buckeystown and Hopehill.

Garrett.—Coal production declined 7 percent, reversing the trend of recent years. Although strip-mined production increased slightly, underground output dropped 20 percent. Curtailed operating rates at Freeport Nos. 3 and 4 mines of W & W Coal Co. and shutdown of the Island No. 1 mine of Sara-Ki Coal Co. were the principal factors in the decline of underground-mined coal output. The State's leading strip-mine producer was Buffalo Coal Co., Inc. Strip mining was mostly in the Kittanning seams; underground mining was mostly in the Freeport seam.

Vetter Bros., Inc., operated the Fry and Browning limestone quarries 9 miles north of Oakland. Each quarry had an average height of 44 feet of face and required stripping 50 feet of overburden. The company employed 22 men during the summer months and had an accident-free record during the year. Limestone was crushed and sold for road material.

Silver Knob Sand Co. produced structural sand from a pit near Oakland.

Harford.—Production and value of sand and gravel dropped 10 and 15 percent, respectively. Eleven operations near Aberdeen, Joppa, Edgewood, and Abingdon produced mostly prepared structural and paving sand and gravel.

Thomas B. Gatch & Sons, Churchville, increased its production of crushed basalt for road material, but the value decreased, reflecting reduced prices during the year. The Maryland Green Marble Co., the only marble producer in the State, operated a quarry near Cardiff and produced sawed, cut, and dressed marble for building interiors and broken stone for terrazzo as a byproduct.

Harford Talc & Quartz Co., Inc., mined and processed talc near Dublin for use in a wide variety of industrial applications.

Kent.—The Kent Concrete Co., Inc., dredged structural sand and gravel from the Chester River near Chestertown.

Miscellaneous clay for building brick was recovered from an open-pit mine near Chestertown by the Chestertown Brick Co.

Montgomery.—Bradley Lane Quarries near Rockville, operated by Albert D. Battista, yielded dimension granite for rough and dressed construction uses. Mica schist was quarried near Bethesda by Stoneyhurst Quarries for rough dimension building stone, rubble, and flagging.

Prince Georges.—The county continued as the leading sand-and-gravel producing area, increasing production and value 55 and 66 percent, respectively. The structural and paving market consumed most of the county output. Seventy percent of the sand and gravel output was prepared by washing or screening. The industry employed over 800 men (including office workers) working an average of 264 days. Principal operations were at Camp Springs, Bowie, Silver Hill, and Forestville. Quantities of sand and gravel were sold to local State agencies for road construction and maintenance.

The Washington Brick Co. (Muirkirk) and the West Bros. Brick Co. (near Washington, D.C.) produced miscellaneous clay, chiefly for building brick. William L. Allen (Laurel) produced plastic fire clay for refractories and for use in foundries and steelworks.

St. Marys.—Structural sand and gravel, paving sand, and gravel for fill were recovered at operations near Hollywood and Leonardtown.

Talbot.—New Brick & Tile Co. used miscellaneous clay mined at an open pit near Easton for manufacturing building brick.

Washington.—The county continued as the second-ranked mineral-producing area in the State, increasing mineral value 10 percent over the preceding year. The value of portland- and masonry-cement shipments comprised over 80 percent of the total value of minerals produced in the county.

North American Cement Corp. quarried and crushed limestone for manufacturing cement, road material, and railroad ballast at the Security plant near Hagerstown. General-use and moderate-heat and high-early-strength portland cements and masonry cement were produced by the dry process. Most of the material was consumed in the State, but large shipments were made to the District of Columbia, Virginia, and Pennsylvania. The company erected 10 storage silos (33 feet in diameter and 140 feet high), which more than doubled storage capacity. A modern packhouse was to be erected adjacent to the silos.

Fry Coal & Stone Co. operated the Pinesburg quarry near Williamsport and produced limestone for concrete aggregate, roadstone, rock dust for coal mines, and stone sand.

Miscellaneous clay for building brick, cement, and fertilizer filler was recovered from an open pit near Williamsport by Victor Cushwa & Sons, Inc.

Byproduct potassium sulfate was prepared from cement clinker at the Security plant of the North American Cement Corp.

Wicomico.—Salisbury Brick Co., Inc., mined miscellaneous surface clays near Salisbury for building brick.

Building and paving sand and paving gravel were recovered at two stationary plants and one portable operation near Salisbury and Hebron., respectively.

The Mineral Industry of Massachusetts

By Robert W. Metcalf [1] and James R. Kerr [1]

◆

THE VALUE of Massachusetts mineral production in 1959 rose to $25.9 million, a new record. The value was 3 percent above 1956, the next highest year, and 8 percent above 1958. Output of sand and gravel, clay, and lime increased substantially over 1958, and production and value of sand and gravel reached new peaks. Middlesex County again led in value of mineral production, followed in order by Berkshire, Norfolk, Essex, and Hampden.

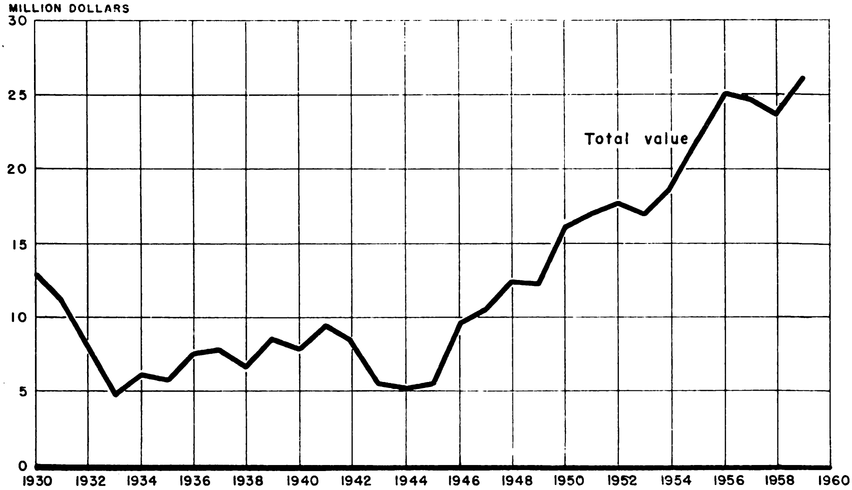

FIGURE 1.—Total value of mineral production in Massachusetts, 1930–59.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production in Massachusetts [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	85	$111	101	$229
Gem stones	(2)	(3)	(2)	1
Lime	139	2,121	144	2,289
Peat short tons	1,014	(4)	773	(4)
Sand and gravel	10,620	10,035	13,210	11,786
Stone	4,649	12,354	5,102	12,375
Value of items that cannot be disclosed: Mineral fuels and nonmetals		9		7
Total Massachusetts [5]		23,887		25,916

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Weight not recorded.

[3] Less than $1,000.

[4] Figure withheld to avoid disclosing individual company confidential data.

[5] Total adjusted to eliminate duplicating value of stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Output of clay rose 19 percent in 1959 to more than 100,000 short tons and was produced by four companies at five locations in three counties. The clay was consumed near the mines to make heavy clay products, including structural brick. The leading clay producing county was Plymouth, followed by Hampden and Bristol.

Gypsum.—Gypsum products were manufactured from calcined Canadian (Nova Scotian) gypsum at Charlestown, Suffolk County.

Lime.—The value of lime rose to nearly $2.3 million, a new record for the State and 3 percent higher than the next highest year, 1957. The tonnage was slightly greater than in 1951, the previous peak year. The average value per ton rose 5 percent compared with 1958. Quick and hydrated lime were consumed for building, chemical, and industrial uses, and hydrated lime was used for agricultural purposes. Lime was obtained from both limestone and dolomite and was burned only in Berkshire County.

TABLE 2.—Lime (quick and hydrated) sold by producers

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	135,605	$1,925,188	1957	137,284	$2,232,731
1955	134,952	1,957,346	1958	139,062	2,120,677
1956	134,248	2,093,195	1959	143,567	2,289,250

Mica.—Shipments of mica from Massachusetts to the General Services Administration (GSA) Materials Purchase Depot at Franklin, N.H., were made for the first time in 1959. Production was from Franklin County.

Nitrogen Compounds.—The Air Reduction Co., Inc., plant at South Acton, Middlesex County, continued to produce nitrogen, oxygen, and argon for industrial uses.

Perlite.—Expanded perlite was sold by one firm at Roslindale in Suffolk County. This material was used in building plaster, in concrete aggregate, and for soil conditioning. Both output and average value per unit decreased compared with 1958.

Roofing Granules.—Bird & Son, Inc., East Walpole, Norfolk County, produced natural and colored granules for use in roofing shingles from miscellaneous stone and basalt quarried in Norfolk and Suffolk Counties. Output of roofing granules rose 6 percent over 1958.

Sand and Gravel.—Stimulated by increased building and highway construction, sand and gravel output rose 24 percent in tonnage and 18 percent in value over 1958 to the highest level on record. However, the average value per ton dropped $0.05 to $0.89, reflecting successful cost-cutting methods applied during the year. All major uses increased significantly, but the increases in paving gravel (75 percent) and fill gravel (52 percent) were the most notable. Seventy percent of the commercial production, which comprised 87 percent of the total, was washed, screened, or otherwise prepared, whereas only 5 percent of the Government-and-contractor production was prepared. Of the total Government-and-contractor output, 94 percent was produced under contract. All of the Government-and-contractor tonnage and 97 percent of the commercial tonnage was shipped by truck. Half of the remaining commercial production was transported by water, and the balance by rail and unspecified methods.

Six counties produced over 1 million tons each. In order of decreasing production, these were Middlesex, Norfolk, Bristol, Plymouth, Worcester, and Hampden.

Employment averaged 942 persons, usually working an 8-hour shift, and totaled 1,664,000 man-hours. Production workers and working proprietors comprised almost 90 percent of the total employment and office workers the balance. Employment in Middlesex and Norfolk Counties, chiefly in the Boston area, comprised 38 percent of the employees and 41 percent of the man-hours.

Stone.—Stone production rose 10 percent over 1958 and consisted of granite, basalt, limestone, sandstone, and miscellaneous stone. Most of the stone was produced commercially, but small quantities of Government-and-contractor basalt and miscellaneous stone were quarried in three counties.

Of the commercial stone, dimension-stone output increased substantially. It comprised mostly granite, with small quantities of dimension basalt and dimension sandstone. The principal use for granite dimension stone was again curbing. Flagging, rubble, and dressed construction stone also used substantial quantities. Other uses were rough construction, dressed monumental, and rough and dressed architectural stone.

Output of crushed and broken stone increased 9 percent and consisted chiefly of basalt, granite, and limestone, with a smaller tonnage of miscellaneous stone. Concrete aggregate and roadstone was the principal use, followed by railroad ballast, agricultural limestone,

TABLE 3.—Sand and gravel sold or used by producers by classes of operations

Use	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	79,529	$252,776	(1)	(1)
Structural	2,529,194	2,558,564	2,912,104	$2,871,307
Paving	1,392,715	1,193,985	1,354,672	1,143,820
Filter	(1)	(1)		
Fill	(2)	(2)	283,543	121,246
Blast, fire and furnace	(1)	(1)	2,000	7,000
Other	664,472	336,370	370,381	251,761
Gravel:				
Structural	2,012,194	2,781,126	2,556,595	3,534,708
Paving	1,393,660	1,505,647	2,436,999	1,966,655
Railroad ballast	13,500	5,000		
Fill	570,796	292,464	869,081	363,089
Other	377,799	204,296	305,434	246,072
Undistributed [3]	18,452	71,309	377,503	570,340
Total	9,052,311	9,201,537	11,468,312	11,075,998
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Structural				
Paving	630,951	313,776	29,155	20,314
Fill			6,903	5,113
Other			3,000	4,500
Gravel:				
Structural			43,000	38,500
Paving	936,539	519,315	995,425	396,895
Fill			664,075	244,773
Total	1,567,490	833,091	1,741,558	710,095
Grand total	10,619,801	10,034,628	13,209,870	11,786,093

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Included with "Other" sand.
[3] Includes filter sand (1958), ground sand, railroad ballast sand (1959), miscellaneous gravel (1959), and uses indicated by footnote 1.

and riprap. A large increase in consumption of granite for road construction was noteworthy.

Thirty-two firms quarried stone in 1959 at 36 commercial quarries, as follows: Basalt, 13 firms at 15 quarries in 8 counties; granite, 13 firms at 14 quarries in 8 counties; limestone, 4 firms at 4 quarries in 1 county; sandstone, 1 firm at 1 quarry; and miscellaneous stone,

TABLE 4.—Stone sold or used by producers, by uses

	1958		1959	
	Short tons	Value	Short tons	Value
Dimension stone (approximate quantities)	119,113	$3,790,374	(1)	(1)
Crushed and broken stone:				
Riprap	(1)	(1)	114,821	$147,725
Concrete aggregate and roadstone	3,435,213	5,686,478	3,730,886	6,015,495
Railroad ballast	(1)	(1)	345,239	508,913
Agricultural (limestone)	117,528	351,529	143,884	425,782
Other uses	624,416	2,041,210	(1)	(1)
Undistributed	[2] 352,797	[2] 484,245	[3] 767,553	[3] 5,277,136
Total (approximate quantities)	4,649,067	12,353,836	5,102,383	12,375,051

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes furnace flux, miscellaneous uses, and items indicated by footnote 1.
[3] Includes dimension stone, furnace flux, and other items indicated by footnote 1.

1 firm at 1 quarry. One firm produced both basalt and limestone. Most of the dimension stone was quarried in Middlesex County and the bulk of the crushed and broken stone in Essex, Norfolk, Hampden, Middlesex, and Berkshire Counties.

Vermiculite.—Exfoliated vermiculite was sold by two companies, one in Middlesex County and one in Norfolk County. Both imported and domestic vermiculite were used.

MINERAL FUELS

Coke.—Owing to a radical change in the fuel use pattern, the domestic (merchant oven) coke market has been gradually replaced by natural gas and oil. Substitution by gas-distributing utilities of natural gas and oil gas for coke-oven gas and water gas made from coke has resulted in the closing of many merchant byproduct coke plants. This trend has affected the Everett plant of the Eastern Gas & Fuel Associates in Middlesex County. The plant, operating at a reduced rate in 1959, was scheduled to close in April 1960. The Everett coke ovens recently have concentrated on foundry-coke production and expect to have a large stock on hand to supply customers when the plant is closed. Orders will be filled from the company's New Haven, Conn., plant.

During 1959 the company doubled the size of its coal treatment laboratories at Everett, adding much new equipment. Research facilities were aimed at manufacturing better and more economical coke and were adequate for testing the behavior of coals in quantities from 1 ounce to 500 pounds and further testing the findings in plant-scale equipment. A new electrically heated pilot-scale coke research oven with a movable sidewall has a 500-pound capacity. Temperature can be controlled to within a few degrees in the 1,000° to 2,000° F. range. Sensitive instruments will record even slight changes in pressure.

Peat.—Peat production came solely from Essex County and dropped below the 1958 output.

METALS

Chromium.—Nuclear Metals, Inc., Concord, extruded pure chromium metal tubing for potential use in jet tubes, rocket nozzles, and nuclear fuel elements. Chromium powder, obtained from Union Carbide Metals Co., was cold-compacted into a mild steel container, heated, placed in a 1,000-ton press, and extruded over a mandrel.

Pig Iron.—The constantly shrinking market for pig iron in New England made it impossible to support operation of the Everett blast furnace of Eastern Gas and Fuel Associates. The one-stack, 195,000-ton-capacity plant was shut down on October 16 and permanently discontinued at the end of 1959. Sales were to continue until inventories were exhausted.

Tantalum.—National Research Corp., Cambridge, developed a series of tantalum-tungsten alloys for use as nozzles and other high-performance solid fuel rocket parts. One alloy had more than three times the tensile strength of tantalum alone at 4,000° F.

Titanium.—An electrolytic process for producing titanium was developed by Norton Co., Worcester, and was expected to reduce costs of recovering this metal. Titanium carbide, containing about 80 percent titanium, was the starting material. Other metals obtainable through this process were said to include chromium, columbium, thorium, tungsten, and zirconium.

REVIEW BY COUNTIES

Basalt for riprap was quarried in Barnstable and Plymouth Counties by the Department of Public Works, Commonwealth of Massachusetts. One city in Berkshire County produced miscellaneous stone for road maintenance.

The Department of Public Works produced sand and gravel under contract and with its own crews in Barnstable, Berkshire, Bristol, Essex, Franklin, Hampden, Middlesex, Nantucket, Plymouth, and Suffolk Counties. Several towns and cities also mined sand and gravel for their own use in highway or street construction in Berkshire, Bristol, Essex, Middlesex, and Suffolk Counties.

TABLE 5.—Value of mineral production, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Barnstable	(1)	$137,521	Sand and gravel, stone.
Berkshire	$3,680,418	3,919,736	Lime, stone, sand and gravel.
Bristol	1,508,815	1,883,573	Sand and gravel, stone, clays.
Dukes	(1)	(1)	Sand and gravel.
Essex	2,453,029	2,687,393	Stone, sand and gravel, peat.
Franklin	(1)	(1)	Sand and gravel, stone.
Hampden	(1)	(1)	Stone, sand and gravel, clays.
Hampshire	(1)	644,946	Sand and gravel, stone.
Middlesex	6,972,570	7,572,861	Stone, sand and gravel.
Nantucket	(1)	1,573	Sand and gravel.
Norfolk	(1)	3,083,685	Sand and gravel, stone.
Plymouth	(1)	1,653,162	Sand and gravel, stone, clays.
Suffolk	790,150	551.628	Stone, sand and gravel.
Worcester	(1)	1,093,770	Sand and gravel, stone.
Undistributed [2]	8,481,586	2,686,429	
Total	23,886,568	25,916,277	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes values indicated by footnote 1 and gem-stone data not allocated by county.

Barnstable.—Molding sand was prepared at a stationary plant near Provincetown by Whitehead Bros. Co. Concrete Products Co. of Cape Cod, Inc., produced building and fill sand near Falmouth. Sand for road paving was mined at various localities throughout the county. Granite for riprap was produced near Falmouth.

Berkshire.—The lime industry in the county operated at more than 80 percent of capacity. Producers were Lee Lime Corp. at Lee, New England Lime Co. at Adams, and U.S. Gypsum Co. at Farnams. Both quick and hydrated lime were produced, chiefly for chemical and industrial uses. Lee Lime Corp. planned to expand its operations by adding a new rotary limekiln, which would more than double the firm's capacity. This company, with McNeil Brothers of Bridgeport, Conn., was to produce a lime-fly ash pozzolanic cement especially designed for concrete-block manufacture. The new cement, called

Pozament, would be manufactured at a new plant at Bridgeport. Lime requirements were to be supplied by the new Lee company kiln and fly ash by Connecticut Light & Power Co.

The three lime-producing companies and John S. Lane & Son, Inc., crushed limestone. Limestone not consumed in the manufacture of lime was used for agricultural purposes and as concrete aggregate. Fifteen sand and gravel producers were active; their output was chiefly building and paving material. Berkshire Gravel Co., Inc., operating stationary plants at Lee and Dalton, produced sand and gravel for building purposes. General Sand & Stone Corp. prepared building sand and gravel and paving gravel at a stationary plant near Dalton. Other large producers were Maxymillian, Inc., and Nicholas Klein, Jr., both at Adams; Abby & Sons, Lee; and Frank Bushika, Cheshire.

Bristol.—Sand and gravel was produced at 15 operations. Tri-City Concrete Co., Inc., operated stationary plants at Dartmouth and Raynham and prepared building and paving sand and gravel and sand for ice-control purposes. Other large producers were Morse Sand & Gravel Co., Attleboro; Joseph Borge & Sons, Inc., Swansea; McCabe Sand & Gravel Co., Taunton; and Victor Medieros, South Dartmouth. Stiles & Hart Brick Co. mined miscellaneous clay at an open pit near Taunton for manufacturing building brick.

Dukes.—Colby Construction Co. produced sand and gravel at Oak Bluffs for use as building and paving material.

Essex.—Production of crushed basalt, chiefly for concrete aggregate, increased 5 percent. Producers were Lynn Sand & Stone Co., Swampscott; Essex Bituminous Concrete Corp., West Peabody; and Trimount Bituminous Products Co., Saugus. Dimension granite for riprap was quarried by the Rockport Quarry Co., Rockport. In 1959, 16 companies reported sand and gravel production, compared with only 8 in 1958. The leading producer was Yemma Bros., Inc., operating a stationary plant near Groveland. Output was chiefly for building uses. Other large producers in the county were Videtta Corp., West Peabody; Essex Sand & Gravel Co., Inc. and Andover Sand & Gravel Corp., Lawrence; Essex Sand & Gravel Co., Inc., Andover; and Miles River Sand and Gravel Co., Ipswich. Peat humus for soil conditioning was produced by Andover Sand & Gravel, Inc., from bogs near Lawrence.

Franklin.—Greenfield Massachusetts Broken Stone Co. quarried basalt, chiefly for concrete and road-base material, railroad ballast, and riprap. Increased coverage for the sand and gravel industry brought responses from six producers, compared with only two in 1958. Leading producers were Joseph W. Zemetra at Sunderland and Northfield Sand and Gravel Co. at Northfield. Output was chiefly for paving use.

William Wilkey and Bradley Freye, of Athol, shipped hand-cobbed mica to the GSA purchase depot at Franklin, N.H. The mica was obtained from the Pitt Hill mine in Orange, just south of the New Hampshire State line.

Hampden.—McCormick Longmeadow Stone Co., Inc., produced dimension sandstone for exteriors of buildings. Output was used in constructing the Peterson house in Washington, D.C.; St. Patricks

Church in Hartford, Conn.; and the St. Thomas Moore rectory in New Haven, Conn. Crushed basalt, used chiefly for concrete aggregate and railroad ballast, was quarried at West Springfield and Westfield by John S. Lane & Sons, Inc. The quarry at West Springfield, which also produced riprap, was idle part of the year. The large quantities of building sand produced in the county attested to increased construction activity. Output was reported by 10 producers. The leading producers were North Wilbraham Sand & Gravel Co., Inc., Monson Sand & Gravel Corp., D. D. Ruxton, and Bay States Gravel. Miscellaneous clay for building brick was produced by Hampshire Brick Co., Chicopee, and Westfield Clay Products Co., Westfield.

Hampshire.—Sand and gravel was mined for various uses but chiefly for building and paving material and for fill. The leading producer was Hampshire Sand & Gravel Co. at Westhampton; others were Bill Willard, Inc., Haber Sand & Gravel Co., and John Omasta, all near Northampton. John S. Lane & Sons, Inc., crushed basalt for concrete aggregate and road-base material from a quarry near Amherst.

Middlesex.—The county remained the leading producing area for sand and gravel. Output was reported by 18 producers; of these, 14 produced more than 100,000 tons. The five largest operators were Acme Sand & Gravel Co., Inc., Burlington; J. J. Cronin Co., Wilmington; Pomerleau Bros., Westford; Thomas Quinn Co., Burlington; and San-Vel Contracting Co., Littleton. Output was localized in the Boston area.

Output of dimension granite was reported by three producers: H. E. Fletcher Co., Morris Bros. Granite Co., Inc. and Oak Hill Granite Co. Inc., all of Westford. The last named was a new operating company in 1959. Production of crushed basalt increased 26 percent, reflecting renewed activity in construction during the year. Output was used principally as concrete aggregate and road-base material. Producers of basalt were: J. P. Condon Corp. (Dracut), Rowe Contracting Co. (Malden), B. & M. Crushed Stone Co. (Ashland), and Winchester Crushed Stone Co. (Woburn).

The Zonolite Co. continued to exfoliate vermiculite at its plant at North Billerica. Both domestic and imported vermiculite were exfoliated. Major uses were concrete and plaster aggregate and insulation. California Products Corp. (formerly California Stucco Products Co.) discontinued its exfoliating plant at Cambridge and relocated near Hingham in Norfolk County.

Eastern Gas and Fuel Associates continued to operate its battery of 108 slot-type coke ovens at Everett. Much of the output of this plant was used as foundry coke.

Norfolk.—Nine producers reported output of sand and gravel. Building sand was the leading type. The principal producers were Highland Sand & Gravel, Inc., at West Roxbury; Magris Pits at Canton-Westport; Wrentham Sand & Gravel Co., Inc., at Wrentham; Glacier Sand & Stone Co., Inc., at Norwood; and Varney Bros. Sand & Gravel, Inc., at Ellingham. Old Colony Crushed Stone Co. and Stoughton Crushed Stone Co. crushed granite for concrete aggregate and road-base material and for stone dust from quarries near Quincy and Wrentham, respectively. Dimension granite, chiefly for rough architectural building use, was produced by Bates Bros., Seam Face Granite Co., and J. S. Swingle, Inc. S. M. Lorusso crushed miscellaneous stone from quarries at Plainville and Wrentham for making roofing granules. No traprock (basalt) was produced during the year.

California Products Corp. exfoliated South African vermiculite near Hingham. Most of this material was consumed in plaster and concrete aggregate and for insulation.

Plymouth.—Sand and gravel output, chiefly for building use, was reported by 12 producers. Leading producers were Boston Sand & Gravel Co., at Scituate; Marshfield Sand and Gravel Co., at Marshfield; and Whitehead Bros. Co., at Marion and Onset. The Whitehead Bros. output was molding sand. The other nine producers were smaller and marketed mostly paving and some building material. Southeastern of Taunton Corp., Inc., operated a quarry for the first year near Taunton and crushed basalt for concrete aggregate and road-base material. The Southeastern Stone, Inc., took over operation of Bradford-Weston, Inc., in June and crushed granite primarily for concrete aggregate but also for riprap. Miscellaneous clay was mined by Bridgewater Brick Co. (East Bridgewater) and Stiles and Hart Brick Co. (South Bridgewater). Output was used entirely for manufacturing building brick.

Suffolk.—Basalt was crushed by West Roxbury Crushed Stone Co., West Roxbury, and William J. Barry Co., Roslindale. Output was principally for concrete aggregate and roadstone, and part of the Barry output was used to make roofing granules. DeMatteo Pits produced a large tonnage of unwashed gravel for paving use. D. B. Raymond produced paving gravel for fill and miscellaneous uses at a stationary plant near Watertown. The Whittemore Co., Permalite Division, expanded perlite at its plant at Roslindale for building plaster, concrete aggregate, and soil conditioning. Crude perlite was obtained from the Western States. The United States Gypsum Co. calcined imported gypsum at Charlestown. Most of the output was consumed in the New England area.

Worcester.—Production of sand and gravel, chiefly for building and paving, was reported by 14 operators. Leading producers were Rosenfeld Washed Sand & Stone Co. (Milford), Worcester Sand & Gravel Co. (Shrewsbury), Raymond Morin (Fitchburg), P. J. Keating Co. (Lunenburg), E. L. Dauphinais, Inc. (Grafton), and Allaire Bros. (Auburn). Basalt for concrete aggregate and for use in bituminous concrete was crushed by Holden Trap Rock Co. at Holden. H. E. Fletcher Co. produced dressed architectural and rough construction dimension granite at its Milford quarry.

The Mineral Industry of Michigan

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Michigan Department of Conservation, Geological Survey Division, State of Michigan.

By Donald F. Klyce[1]

◆

INCREASED demand for construction materials, basic chemicals, and fuels helped increase the value of Michigan mineral production by 10 percent.

Records were established in value of shipments of cement, gypsum, lime, peat, salt, sand and gravel, and chemicals derived from well brines. The 116-day steel strike reduced the shipments of iron ore. Output of copper was slightly less than in 1958, but an increase in unit price resulted in higher value for the copper shipped in 1959.

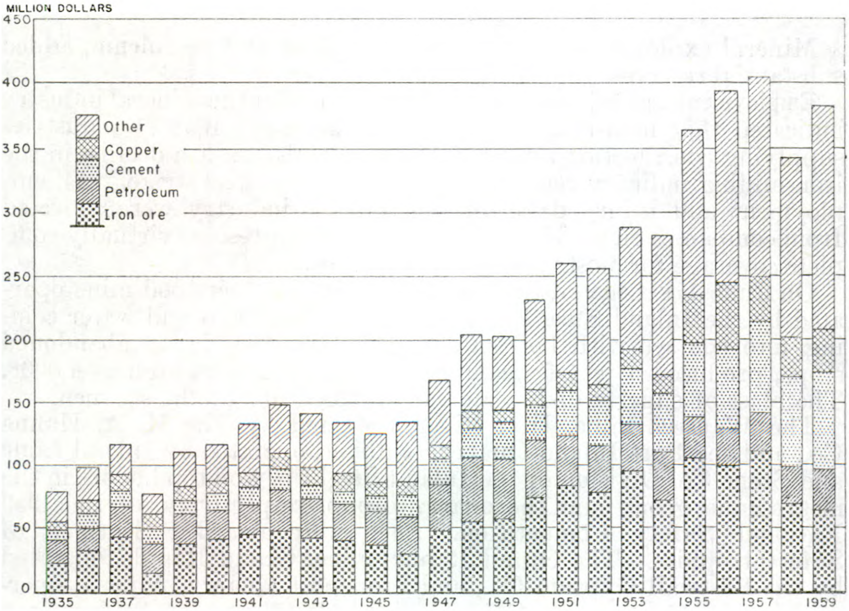

FIGURE 1.—Value of iron ore, petroleum, cement, copper, and total value of all minerals in Michigan, 1935–59.

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[1] Commodity-industry analyst, Minneapolis Office of Mineral Resources, Region V, Bureau of Mines, Minneapolis, Minn.

TABLE 1.—Mineral production in Michigan[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland .... thousand 376-pound barrels..	19,691	$65,738	21,682	$72,198
Masonry .... do....	1,221	4,694	1,344	5,126
Clays .... thousand short tons..	1,663	1,813	1,771	1,937
Copper (recoverable content of ores, etc.)	58,005	30,511	55,300	33,954
Gypsum (crude) .... thousand short tons..	1,331	4,824	1,721	6,595
Iron ore (usable) .... thousand long tons, gross weight..	8,111	69,845	7,247	62,921
Lime	(2)	(2)	861,808	11,748
Manganiferous ore (5 to 35 percent Mn) ... gross weight..	112,536	(2)	....	....
Natural gas .... million cubic feet..	14,243	2,649	[3] 12,300	[3] 2,300
Peat	107,342	1,684	191,661	2,357
Petroleum (crude) .... thousand 42-gallon barrels..	9,308	27,366	[3] 10,438	[3] 30,688
Salt (common) .... thousand short tons..	4,267	33,018	4,485	35,725
Sand and gravel [4] .... do....	39,871	34,616	48,052	41,193
Stone .... do....	27,188	26,846	30,095	30,379
Value of items that cannot be disclosed: Bromine, calcium-chloride and calcium-magnesium chloride, gem stones, magnesium compounds, natural-gas liquids, potassium salts, and values indicated by footnote [2] ...	....	45,558	....	49,371
Total Michigan [5]	....	[6] 343,487	....	379,244

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Preliminary figure.
[4] Includes friable sandstone.
[5] Total adjusted to eliminate duplication in value of clays and stone.
[6] Revised figure.

Mineral exploration, particularly in copper and petroleum, added substantial reserves.

Employment and Injuries.—Preliminary data for the mineral industry indicated that man-hours worked increased over 1958 in industries supplying construction and chemical materials, while a decline in the iron-mining industry reflected the effects of the steel strike. All employment and injury data for the mineral industry were collected from companies on a voluntary basis. Data represents virtually complete coverage for most mineral commodities.

On June 1, six men died in a disaster in the Sherwood mine operated by the Inland Steel Co., Iron River. Underground water coming into contact with hot slate, caused by a fire in an abandoned stope, produced a jet of steam with temperatures as high as 1,000°. The blast of superheated steam caused the death of the six men.

The Wauseca mine, Iron River, operated by The M. A. Hanna Co., and the Port Inland Quarry, Gulliver, operated by Inland Lime and Stone Co. Division of the Inland Steel Co. won top honors in the metal mine group and the quarry group, respectively, of the 1959 National Safety Competition. Each were awarded Sentinels of Safety trophies. The Grand Rapids mine, Grand Rapids, operated by the Bestwall Gypsum Co., and Stoneport Quarry, Alpena, operated by the Presque Isle Corp. received Certificates of Achievement in Safety for being among the five nonmetal mines and five quarries, respectively, having the lowest injury-severity rates in the National Safety Competition.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Michigan [1]

Year and commodity	Average number of men working	Total man-hours	Total number of lost-time injuries: Fatal	Total number of lost-time injuries: Nonfatal	Total number days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
1958							
Cement [4]	1,714	4,812,817	1	14	(5)	3.12	(5)
Clay [6]	155	336,889	--------	8	63	23.75	187
Coke ovens	795	2,274,451	1	7	(5)	3.52	(5)
Copper	1,891	3,592,338	3	119	25,185	33.96	7,011
Gypsum	376	887,410	--------	2	32	2.25	36
Iron ore	6,115	8,073,486	8	183	59,171	23.66	7,329
Limestone [7]	1,376	2,570,844	--------	27	(5)	10.50	(5)
Marl	79	54,787	--------	1	20	18.25	365
Sand and gravel	2,233	3,873,706	--------	86	2,668	22.20	689
Sandstone	14	27,925	--------	--------	--------	--------	--------
Smelters	342	668,045	--------	8	404	11.98	605
1959							
Cement [4]	1,662	4,582,305	--------	17	(5)	3.71	(5)
Clay [6]	257	559,002	--------	10	45	17.89	81
Coke ovens	1,032	2,687,416	--------	8	(5)	2.98	(5)
Copper	1,858	3,727,573	4	89	28,592	24.95	7,670
Gypsum	541	1,140,359	--------	15	459	13.15	403
Iron ore	5,415	7,418,528	7	204	55,033	28.44	742
Limestone [7]	1,612	2,777,824	--------	19	(5)	6.83	(5)
Marl	84	69,292	--------	--------	--------	--------	--------
Sand and gravel	2,567	4,134,368	--------	74	8,314	17.90	2,011
Sandstone	20	32,947	--------	2	(5)	60.70	(5)
Smelters	321	667,620	--------	12	151	17.97	226

[1] Data exclude office workers; are final for 1958 and preliminary for 1959.
[2] Defined as the total number of injuries per million man-hours.
[3] Defined as the total number of days lost or charged per million man-hours.
[4] Includes cement plants and quarries or pits producing raw material used in manufacturing cement
[5] Figure not available.
[6] Excludes pits producing clay used exclusively in manufacturing cement.
[7] Excludes quarries producing limestone used exclusively in manufacturing cement and lime.

Trends and Developments.—The St. Lawrence Seaway, opened in 1959, had a salutary effect on Michigan economy. Port developments, completed, under construction, and projected, will facilitate water shipments of Michigan mineral commodities. In 1959 over one-third of the mineral output was shipped by water.

During the year Dundee Cement Co. completed construction of its plant in Monroe County.

In May National Gypsum Co. made its first shipment of crude ore from its new port at Tawas City.

Drummond Dolomite Co. continued development of its new quarry on Drummond Island in Chippewa County.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments and value of cement increased 10 percent over 1958. For the first time cement displaced iron ore as the State's ranking mineral commodity.

Production was reported from eight plants in six counties. Capacity of plants in the State was over 25 million barrels. Stocks of portland cement at mills at yearend was 2.3 million barrels, approximately the same as in 1958.

Average mill value of portland cement was $3.33 a barrel in 1959, compared with $3.34 in 1958. The price of masonry cement was $3.81 a barrel compared with $3.84 in 1958.

Over two-thirds of the cement shipped was used within the State. Shipments out of State went mainly to Wisconsin, Ohio, New York, Illinois, Minnesota, North Dakota, and Indiana.

About 5.4 million tons of limestone, 1.6 million tons of clay and shale, and substantial quantities of gypsum, lime mud, sand, glass sludge, mill scale and pyrite cinders, and slag were used in manufacturing cement. Small quantities of special materials were employed as grinding aids.

TABLE 3.—Finished portland cement produced, shipped, and in stock

Year	Active plants	Production (thousand barrels)	Shipped from mills		Stocks at mills on Dec. 31 (thousand barrels)
			Thousand barrels	Value (thousands)	
1950–54 (average)	7	14,871	14,859	$37,822	1,423
1955	7	18,205	18,128	52,353	1,525
1956	8	20,485	20,237	61,749	1,779
1957	8	21,015	20,590	65,996	2,204
1958	8	19,841	19,691	65,738	[1] 2,443
1959	8	21,561	21,682	72,198	2,322

[1] Revised figure.

Clays.—Miscellaneous clay production increased 6 percent over 1958. Nearly seven-eighths of the clay mined was used in manufacturing cement. Other uses were in manufacturing heavy clay products (building brick, paving brick, draintile, and sewer pipe), lightweight aggregate, art pottery, and miscellaneous.

Clay was produced in 10 counties at 16 operations. Alpena, Wayne, and Saginaw Counties reported the largest production.

Gem Stones.—Agate, native copper specimens, Petoskey limestone, celestite, thomsonite, and granite were produced. Much of the material was found on Lake Superior beaches of the Northern Peninsula. Several other varieties of semiprecious stones were found. Total output of gem stones, however, was negligible in value, compared with other mineral commodities produced in the State.

Gypsum.—Gypsum was quarried in Iosco County and mined underground near Grand Rapids in Kent County. The raw material was processed at plants in National City, Grand Rapids, and Detroit. Principal products were plasterboard, exterior sheathing, lath, and plaster.

Production of crude gypsum increased 29 percent over 1958.

Lime.—Lime production was reported from Bay, Chippewa, Ingham, Mason, Menominee, and Wayne Counties. Four manufacturers produced only quicklime, one company produced only hydrated lime, and one produced both.

Annual lime-burning capacity of plants in the State exceeded 950,000 tons; 30 kilns and 8 hydrators were used.

Principal uses for lime in Michigan were for production of alkalis and other chemicals used in metallurgy, paper manufacture, and sewage treatment.

Natural Salines.—Natural well brines from two geological formations were source material for recovery of bromine, calcium chloride, calcium-magnesium chloride, magnesium compounds, and potash.

Brines from Filer standstone supplied chemical plants in Mason and Manistee Counties; plants in Gratiot, Lapeer, and Midland Counties recovered chemicals from brines of the Sylvania formation.

Production of chemicals from these sources increased 20 percent over the previous year.

Perlite.—Perlite was expanded at plants in Grand Rapids and National City from crude ore mined in Colorado and Nevada. The principal use was in building plaster. Small quantities were used in concrete aggregate, soil conditioning, and miscellaneously.

Salt.—Salt production came from natural brines of the Dundee and Marshall formations, artifical brines formed by dissolving salt from the Salina formation, and one underground mine. Production was reported from 10 plants in 6 counties. Largest production came from Wayne County, which included output of International Salt Co.'s underground mine and artificial brine operations of Pennsalt Chemical Corp. and Wyandotte Chemicals Corp. Production of salt in Michigan was 5 percent greater in 1959 than in 1958.

Salt was used for a wide variety of industrial purposes, and a major portion utilized by the chemical industry. Over 750,000 tons was purchased by Government agencies for ice control on highways.

Sand and Gravel.—Sand and gravel was produced throughout the State from glacial deposits, present-day beaches, river channels and lakes, and sand dunes. Production was reported from 79 of the 83 counties in the State.

Output of sand and gravel was one-fifth larger than in 1958. Increased activity in the highway-construction program and increased demand from the building industry were prime factors. The U.S. Army Corps of Engineers utilized several million tons of materials for airbase improvements in the Upper and Lower peninsulas.

Requirement of sands for industrial uses—molding, glass, blasting, grinding, polishing, and other—followed an upward trend, and nearly one-sixth more tonnage was shipped than in 1958.

Nearly 43 million tons of sand and gravel was moved by truck, 2.7 million tons by rail, and 2.3 million tons by water. Water movements increased more than 75 percent over 1958.

The Detroit area (Livingston, Macomb, Oakland, Washtenaw, and Wayne Counties) produced over a third of the sand and gravel. Major production also came from Calhoun, Delta, Ingham, Kent, Muskegon, Ottawa, and Tuscola Counties.

Commercial production was reported from 244 operations, and 113 noncommercial or Government-and-contractor operations.

The 10 largest producers, listed alphabetically, were:

American Aggregates Corp. (Kalamazoo, Livingston, and Oakland Counties)
Bark River Constr. Co. (Delta County)
Champion, Inc. (portable operation)
Construction Aggregates Corp. (Ottawa County)
Michigan Silica Co. (Wayne County)
Pickitt & Schreur (portable operation)
Sand Products Corp. (Manistee and Muskegon Counties)
Straits Aggregate & Equipment Corp. (portable operation)
I. L. Whitehead Co. (Chippewa County)
Whittaker & Gooding Co. (Washtenaw County)

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:[1]				
Molding	1,792	$2,321	1,919	$2,849
Building	4,003	3,227	4,825	3,752
Paving	4,150	3,772	4,736	4,188
Engine	41	45	63	73
Filter	19	12	1	1
Fill	1,404	507	1,288	531
Other	35	33	40	31
Undistributed [2]	454	1,256	663	1,617
Total	[3] 11,899	11,173	13,535	13,042
Gravel:				
Building	3,951	4,579	4,274	5,095
Paving	14,258	12,743	16,997	15,949
Railroad ballast	158	170	(4)	(4)
Fill	299	178	361	252
Other	54	54	307	334
Total	[3] 18,721	17,724	21,939	21,630
Total sand and gravel	30,619	28,898	35,474	34,672
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	6	3	4	2
Paving	1,197	467	2,362	1,039
Fill	-----	-----	578	135
Total	1,203	470	2,944	1,176
Gravel:				
Building	-----	-----	30	12
Paving	8,049	5,248	9,436	5,297
Fill	-----	-----	165	34
Other	-----	-----	3	2
Total	8,049	5,248	9,634	5,345
Total sand and gravel	9,252	5,718	12,578	6,521
ALL OPERATIONS				
Sand	13,102	11,643	16,479	14,218
Gravel	26,770	22,972	31,573	26,975
Grand total	[3] 39,871	[3] 34,616	48,052	41,193

[1] Includes friable sandstone.

[2] Includes blasting, glass, grinding and polishing, and other ground and unground industrial sands (1958–59) and railroad ballast (1959).

[3] Does not add to exact total because of rounding.

[4] Included with "Other" gravel to avoid disclosing individual company confidential data.

Stone.—Basalt, limestone, and sandstone were produced.

Crushed limestone.—Limestone was quarried and crushed in 17 counties by 21 producers at 22 sites. Most of the output came from counties in the northern part of the State in the area bordering Lakes Huron and Michigan. Several large operators maintained port facilities near their quarry and mill sites. About 24 million tons was moved by water transport to industrial users (cement and lime plants, steel mills, and other industries). The marketing area via the Great Lakes included Michigan, Illinois, Indiana, Minnesota, New York, Ohio, and Pennsylvania. Crushed limestone shipments were 10 percent larger than in 1958. Despite the steel strike the demand for flux stone increased by nearly 2 million tons over the previous year. Of the 30 million tons shipped, 10.8 million tons was used by the steel industry for flux, 12.5 million tons by cement, chemical, and lime manufacturers, and 5.9 million tons by concrete aggregate and roadstone consumers. Miscellaneous users, including farmers who used limestone, made up the balance.

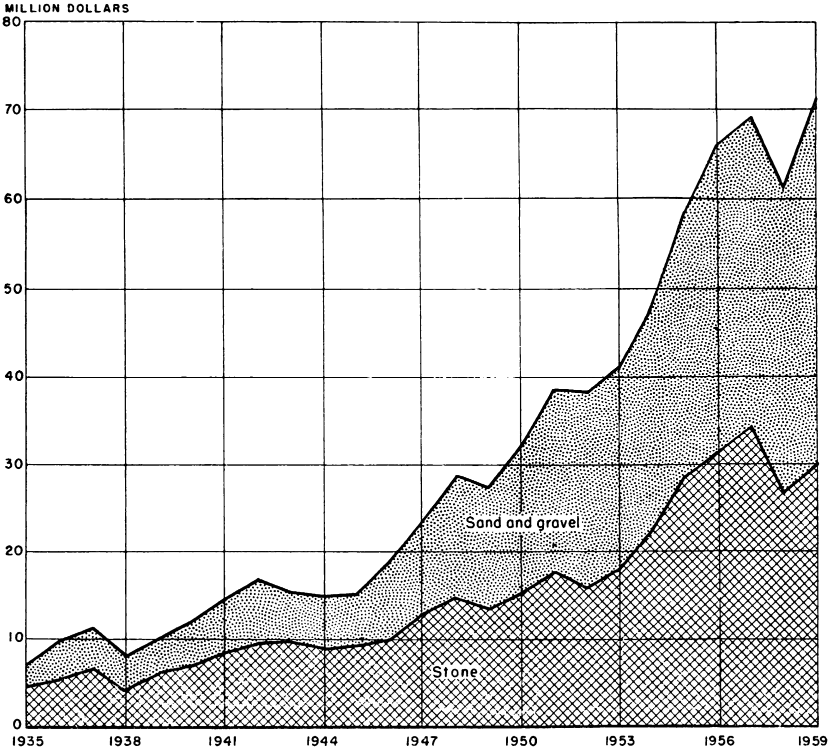

Figure 2.—Value of sand and gravel and stone in Michigan, 1935–59.

TABLE 5.—Dimension stone sold or used by producers, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	29,907	$113,912	9,429	$79,410	39,336	$193,322
1956	35,017	110,159	11,190	90,820	46,207	200,979
1957	34,741	105,854	17,889	70,142	52,630	175,996
1958	50,965	120,361	18,776	132,981	69,741	253,342
1959	6,503	58,120	21,779	154,510	28,282	212,630

TABLE 6.—Crushed and broken stone sold or used by producers, by kinds and uses

(In thousands)

Kind and use	1958		1959	
	Short tons	Value	Short tons	Value
Basalt: Concrete aggregate, roadstone: Noncommercial	31	$34	86	$64
Limestone:				
Flux	8,821	9,064	10,806	11,479
Concrete aggregate, roadstone:				
Commercial	5,646	6,290	5,490	6,393
Noncommercial	544	657	361	406
Agriculture	487	695	434	750
Other:				
Commercial [1]	11,359	9,722	12,684	10,949
Noncommercial			5	8
Total commercial	26,313	25,771	29,414	29,571
Total noncommercial	544	657	366	414
Total limestone	26,857	26,428	29,780	29,985
Marl, calcareous: Agriculture	230	130	201	118
Sandstone: Filler	1	(2)		
Total commercial	26,544	25,902	29,615	29,689
Total noncommercial	574	691	452	478
Grand total	27,118	[3] 26,592	30,067	30,167

[1] Includes limestone for riprap, railroad ballast, chemical uses, refractory, whiting or whiting substitutes, asphalt, dust for coal mines, mineral food, poultry grit, stone sand, cement, lime, and other miscellaneous purposes.

[2] Less than a thousand.

[3] Does not add to exact total because of rounding.

The largest producers, in alphabetical order, were:

Drummond Dolomite, Inc. (Chippewa County)
The France Stone Co. (Monroe County)
Huron Portland Cement Co. (Alpena County)
Inland Lime & Stone Co. (Mackinac County)
Michigan Limestone Div. of U.S. Steel Corp. (Mackinac & Presque Isle Counties)
The Michigan Stone Co. (Monroe County)
Penn-Dixie Cement Corp. (Emmet County)
Pickitt & Schreur, Inc. (various counties)
Presque Isle Corp. (Chemstone Corp.) (Presque Isle County)
The Wallace Stone Co. (Huron County)

Dimension limestone.—Small quantities of dimension limestone were quarried in Charlevoix, Eaton, Huron, and Presque Isle Counties. It was used mainly as rough construction stone and rubble.

Dimension sandstone.—Dimension sandstone was quarried from the Marshall sandstone in Hillsdale and Jackson Counties. It was used principally for rough construction, rubble, and flagging.

Basalt.—Basalt from Precambrian rocks was quarried in Houghton County. It was crushed for road use.

Marl.—Marl pits in 18 counties yielded about 200,000 tons of material, all used to neutralize acid soils. Production dropped about 12 percent from 1958. Because of its bulk and low value, transportation costs limited distribution to relatively small areas. Principal production came from Branch, Isabella, and Kalamazoo Counties.

Sulfur.—Byproduct sulfur was recovered from crude petroleum in Detroit at the Aurora refinery of the Ohio Oil Co. The Clauss process was used.

METALS

Copper.—Production decreased nearly 5 percent, but higher unit value increased the value of shipments by $3.4 million. Output was reported from 10 underground mines and 3 tailing-reclamation plants.

Calumet & Hecla, Inc. operated eight mines, one reclamation plant, and one smelter in Houghton and Keweenaw Counties. Copper Range Co. shipped ore from the Champion mine and tailings from Redridge to the Freda Mill. Concentrate from the mill was processed at the White Pine Copper Co. smelter. Quincy Mining Co. operated a tailing-reclamation plant and a smelter at Hancock. White Pine Copper Co. operated a mine, mill, and smelter in Ontonagon County.

No silver was recovered in 1959, as virtually all output was fire refined and marketed as "Lake copper" at a slight price premium because of the silver content. A small portion of the copper was produced as copper oxide and other copper chemicals.

The average weighted price increased from 26.3 to 30.7 cents a pound. The price quoted by primary producers for electrolytic copper, delivered, opened in 1959 at 29 cents a pound, rose to 31.5 cents a pound in March, and on November 12 it was quoted at 33 cents. The latter price held until yearend.

TABLE 7.—Mine production of copper in 1959, by months, in terms of recoverable metal

Month	Short tons	Month	Short tons
January	5,010	August	5,220
February	4,590	September	5,040
March	5,115	October	5,470
April	5,615	November	1,600
May	5,470	December	1,585
June	5,505		
July	5,080	Total	55,300

TABLE 8.—Mine production of copper in 1959, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailing	Ore (short tons)	Tailing (short tons)	Short tons	Value
1950–54 (average)	9	3	2,206,985	2,035,313	23,995	$12,199,326
1955	11	2	5,319,699	1,488,854	50,066	37,349,236
1956	12	3	6,427,095	2,233,599	61,526	52,297,100
1957	14	3	5,939,034	2,369,546	58,400	35,156,800
1958	11	2	5,957,879	1,336,077	58,005	30,510,630
1959	10	3	5,666,533	1,940,455	55,300	33,954,200

The producing companies mined and milled the ore, smelted the concentrate, and used much of the refined metal in their fabricating plants.

Iron ore.—Iron-ore shipments were 10 percent below the 10-year low recorded in 1958. The 116-day steel strike led to this decrease in output. Twenty-two underground and five open-pit mines were active in 1959.

Mining costs continued to rise, exceeding the record established in 1958. According to a study by the Geological Survey Division, Michigan Department of Conservation,[2] average cost per ton in underground mines was $11.34 in 1959 compared with $10.68 in 1958. The cost per ton for labor rose to $3.46 from $3.12, supplies to $1.52 from $1.39, taxes (excluding Federal Income tax) to $0.84 from $0.82, and general overhead to $1.19 from $0.99. Marketing costs remained at $0.07, while transportation costs decreased to $3.20 from $3.30.

Average cost per ton for underground mines on the Menominee range was $10.08 compared with $9.52 in 1958, on the Marquette range $11.63 compared with $10.79, and on the Gogebic range $13.10 compared with $13.22.

Underground mines furnished nearly four-fifths of the crude ore mined. Average iron content of usable ore produced was 53.17 percent natural.

TABLE 9.—Production, shipments, and stocks of crude iron ore in 1959, by counties and ranges [1]

(Thousand long tons)

County and range	Stocks of crude ore, Jan. 1, 1959	Production		Shipments		Stocks of crude ore, Dec. 31, 1959
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Dickinson	4	-	496	7	494	-
Gogebic	401	1,663	-	1,249	-	815
Iron	732	2,403	-	2,319	-	816
Marquette	1,859	2,751	1,309	2,293	1,972	1,655
Total	2,996	6,817	1,806	5,867	2,466	3,285
Range:						
Gogebic	401	1,663	-	1,249	-	815
Marquette	1,859	2,751	1,309	2,293	1,972	1,655
Menominee	736	2,403	496	2,326	494	816
Total	2,996	6,817	1,806	5,867	2,466	3,285

[1] Exclusive of iron ore containing 5 percent or more manganese.

TABLE 10.—Usable iron ore shipped from mines, by ranges [1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1950–54 (average)	4,874	4,254	3,119	12,247
1955	6,640	4,326	3,178	14,144
1956	5,689	3,889	2,958	12,536
1957	5,993	4,297	2,833	13,123
1958	3,722	2,995	1,394	8,111
1959	3,530	2,469	1,249	7,247

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.

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[2] Michigan Department of Conservation, 1959 General Statistics Covering Costs and Production of Michigan Iron Mines: Geol. Survey Div., Lansing, Mich., June 1960, p. 9.

TABLE 11.—Usable iron ore produced, by ranges [1]

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total
1950–54 (average)	5,166	4,263	3,126	12,554
1955	5,413	4,018	2,879	12,311
1956	5,869	4,264	2,910	13,043
1957	6,557	4,201	2,868	13,626
1958	4,111	2,896	1,397	8,404
1959	2,851	2,616	1,663	7,129
Total 1854–1959	302,816	[2] 250,598	[2] 242,115	795,529

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.
[2] Distribution by range partly estimated before 1906.

Shipments of concentrate from low-grade jaspilite ores continued to increase and represented 8.5 percent of 1959 iron-ore shipments.

Estimated reserves of iron ores in Michigan were 128 million tons at the end of 1959,[3] not including about 1.8 billion tons [4] of low-grade hematitic ore.

The average weighted mine value of Michigan iron ore, without respect to grade, was $8.68 a long ton compared with $8.61 in 1958.

Most of the iron ore was shipped to manufacturers of pig iron and steel. A small quantity of crude ore was used by manufacturers of iron-oxide pigments. Nearly 96 percent of the iron ore shipped was transported by rail to ore docks at Ashland, Wis. and Escanaba and Marquette, Mich.; it was then sent by vessel to lower lake ports. The balance was transported by rail to consuming districts.

Dates of first and last lake shipments of ore in 1959 from Michigan and Wisconsin ports were: Ashland—C&NW—Soo, April 24–November 18; Escanaba—C&NW, April 10-December 8; Marquette—DSS&A, April 27–December 4; Marquette—LS&I, April 24–December 12; Superior—GN, April 17–December 20; Superior—NP—Soo, April 27–December 29.

TABLE 12.—Manganiferous iron ore (containing 5 to 10 percent manganese, natural) and ferruginous manganese ore (containing 10 to 35 percent manganese, natural) shipped from mines

Year	Long tons	Year	Long tons
1950–54 (average)	53,741	1958	100,479
1955–56	------	1959	------
1957	110,310		

Manganiferous Ore.—No manganiferous ore (containing 5 to 35 percent manganese, natural) was mined in Michigan in 1959.

Pig Iron and Steel.—Steel manufacturing was concentrated in Wayne County. Five companies (Allegheny Ludlum Steel Corp., Ford Motor Co., Great Lakes Steel Corp., Jones & Laughlin Steel Corp., and McLouth Steel Corp.) had a rated annual capacity of ingots and steel for castings of nearly 8 million tons on January 1, 1960. Michigan steel capacity represented 5.4 percent of U.S. total.

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[3] Work cited in footnote 2.
[4] Pardee, F. G., and Kennedy, B. E., Low-Grade Ore Occurrences in Michigan. Univ. of Minnesota, 9th Ann. Min. Symposium, 1948, p. 24.

According to statistics published by the American Iron and Steel Institute, steel production in Michigan totaled 5,637,363 tons.

The capacity of Michigan blast furnaces was 5,290,250 tons January 1, 1960. Pig-iron shipments increased 30 percent, and value increased 33 percent. Basic and Bessemer grades were produced. Production of pig iron required large additions of coke and limestone to the iron ore.

Ford Motor Co. announced a $30 million modernization program at its Rouge works in Dearborn. The program was to include additional blast-furnace and open-hearth capacity, increased annealing facilities, and new soaking pits.

Great Lakes Steel Corp. announced plans for a $100 million expansion program. A new 80-inch stripmill was to be built near the main plant in Ecorse; completion is scheduled for mid-1961.

MINERAL FUELS

Natural Gas and Natural Gas Products.—The Overisel field in Allegan County continued to be the leading gas producer and in 1959 accounted for over half of State production. Other large fields were Northville field in Wayne and Washtenaw Counties, Beaver Creek field in Crawford and Kalkaska Counties, St. Helen field in Roscommon County, Howell field in Livingston County, and the Rose City field in Ogemaw County. These 6 fields accounted for over four-fifths of State total, although some production was reported from 34 dry gas fields, 14 oil and gas fields, and 2 gas-storage reservoirs.

Peat.—Peat production increased for the seventh consecutive year. Peat was produced from bogs in 18 counties; largest production was reported from St. Clair, Lapeer, Oakland, and Sanilac Counties. Output was sold mainly as a soil conditioner.

Petroleum.—Increase in petroleum production in 1959 was the first registered since 1948. Output was 12 percent greater than in 1958. Undeveloped acreage reported under lease at yearend was double the 1958 total.

According to data published by the Oil and Gas Section, Geological Survey Division, Michigan Department of Conservation,[5] discovery and exploration wells opened six new oilfields, four new gasfields, four extensions to oilfields, and three new pools. In addition, one oil pool and one gas pool were discovered by reworking older completions. Subsurface geology continued to be the major tool of exploration. Numerous tests also were drilled as a result of gravity surveys and trend geology. Of the discoveries recorded, eight were attributed to subsurface geology, five to trend geology, three to gravity surveys, and two to nontechnical causes. Development of the Trenton-Black River structure in southern Michigan was to continue as well as search for similar features elsewhere. The Salina-Niagara formation also was to receive attention.

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[5] Price, Lyle W., Acker, Robert M., Hautau, Gordon H., Ives, Robert E., Michigan Dept. of Conservation, Geol. Survey Div., 1959 Summary of Operations, Oil and Gas Fields, Lansing, Mich., May, 1960, 44 pp.

Much of the drilling was along the Albion-Pulaski-Scipio trend of the Trenton-Black River formation. Eighty-three producing wells were added in this area in 1959 making a total of 108. Production from these wells in Calhoun, Hillsdale, and Jackson Counties totaled 2,046,000 barrels in 1959, nearly four times the 527,000 barrels recorded in 1958. Reversal in direction of the Michigan oil industry was largely due to the discovery and development of this area. Production was from a secondary dolomite and confined to a fracture zone. The zone varied in width to a maximum of three-fourths of a mile, and at yearend was 25 miles long, extending in a south-southeast and north-northwest direction. Producing wells were in or on the flanks of the depression. Linear limits of the trend had not been established. Indications were that extensions would connect, in part at least, the Albion, Pulaski, and Scipio fields.

Petroleum was produced in 41 counties. In addition to the production cited above, large output came from Isabella, Montcalm, Bay, Osceola, and Arenac Counties. Thirteen refineries, with a rated capacity of 183,000 barrels daily, were operated.

REVIEW BY COUNTIES

Of the 83 counties in Michigan, only Benzie County did not report mineral production in 1959. Sand and gravel was produced in 79 counties and was the only mineral commodity reported in 11 counties. Stone was the only mineral commodity reported for Presque Isle County.

Value of mineral production exceeded $1 million in 44 counties.

Wayne County again led in mineral production. Total values increased in 44 counties and decreased in 38. The largest losses were recorded in counties producing iron ore, reflecting the effects of the steel strike.

Allegan.—Production of petroleum was reported from 15 fields; the Dorr and Salem fields provided more than half of the output of 197,000 barrels. The Rabbit River field was abandoned in 1959.

Peat was dug from bogs near Grand Rapids and Wayland.

TABLE 13.—Value of minerals produced in Michigan, by counties [1]

County	1958	1959	Minerals produced in 1959 in order of value
Alcona	$118,886	$96,987	Sand and gravel.
Alger	214,809	75,208	Do.
Allegan	955,010	1,354,369	Sand and gravel, petroleum, peat, stone.
Alpena	33,557,919	39,446,554	Cement, stone, clays, sand and gravel.
Antrim	85,701	192,245	Clays, sand and gravel.
Arenac	2,031,964	1,878,822	Petroleum, stone, sand and gravel.
Baraga	39,530	43,652	Sand and gravel.
Barry	473,367	702,022	Sand and gravel, petroleum, stone.
Bay	(2)	10,412,398	Cement, petroleum, lime.
Benzie	13,342	----------	
Berrien	457,954	979,650	Sand and gravel, stone, peat.
Branch	(2)	357,269	Sand and gravel, stone.
Calhoun	327,948	4,049,465	Sand and gravel, petroleum, stone.
Cass	173,298	184,723	Sand and gravel, stone.
Charlevoix	58,767	19,869	Stone, sand and gravel.
Cheboygan	62,327	226,850	Sand and gravel, stone.
Chippewa	(2)	4,796,961	Stone, lime, sand and gravel.
Clare	1,774,819	1,426,603	Petroleum, sand and gravel.

See footnotes at end of table.

TABLE 13.—Value of minerals produced in Michigan, by counties[1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Clinton	$387,251	$369,344	Sand and gravel, clays, peat.
Crawford	616,990	538,403	Petroleum, sand and gravel.
Delta	322,219	1,199,432	Sand and gravel, stone.
Dickinson	389,550	1,398,716	Iron ore, stone, sand and gravel.
Eaton	418,644	461,115	Sand and gravel, stone, clays, peat.
Emmet	9,195,437	10,210,091	Cement, stone.
Genesee	459,132	766,612	Sand and gravel, petroleum.
Gladwin	1,493,077	1,491,151	Petroleum, sand and gravel.
Gogebic	11,916,190	10,530,773	Iron ore, sand and gravel, stone.
Grand Traverse	(2)	8,778	Sand and gravel.
Gratiot	(2)	(2)	Salines, salt, petroleum, sand and gravel.
Hillsdale	2,136,795	5,116,765	Petroleum, sand and gravel, stone.
Houghton[3]	30,946,690	34,361,400	Copper, sand and gravel, stone.
Huron	1,049,293	981,387	Stone, sand and gravel, petroleum.
Ingham	641,421	1,171,167	Sand and gravel, lime, peat.
Ionia	824,789	44,592	Sand and gravel, petroleum.
Iosco	(2)	(2)	Gypsum, sand and gravel.
Iron	25,331,024	19,066,278	Iron ore, sand and gravel.
Isabella	2,942,892	2,802,591	Petroleum, sand and gravel, stone.
Jackson	595,851	1,489,030	Sand and gravel, petroleum, stone.
Kalamazoo	771,997	942,071	Sand and gravel, stone, peat, petroleum.
Kalkaska	152,381	120,332	Petroleum, sand and gravel.
Kent	2,996,081	2,883,610	Sand and gravel, gypsum, petroleum, peat.
Lake	102,847	41,373	Petroleum, sand and gravel.
Lapeer	921,294	843,826	Peat, salines, sand and gravel.
Leelanau	57,307	19,553	Sand and gravel.
Lenawee	3,691,986	4,144,759	Cement, sand and gravel, clays, peat.
Livingston	2,669,798	2,782,504	Sand and gravel.
Luce	174,787	103,779	Do.
Mackinac	(2)	(2)	Stone, sand and gravel.
Macomb	1,198,716	1,241,348	Sand and gravel, peat.
Manistee	11,925,724	12,594,089	Salines, salt, sand and gravel.
Marquette	34,148,536	32,750,353	Iron ore, sand and gravel.
Mason	(2)	(2)	Salines, lime, petroleum, sand and gravel.
Mecosta	296,874	231,775	Petroleum, sand and gravel, stone.
Menominee	(2)	972,233	Lime, sand and gravel.
Midland	(2)	(2)	Salines, salt, petroleum, potash, sand and gravel.
Missaukee	1,307,090	1,364,610	Petroleum, sand and gravel, stone.
Monroe	1,437,952	1,224,003	Stone, peat, petroleum, sand and gravel, clays.
Montcalm	2,957,505	2,901,899	Petroleum, sand and gravel, peat.
Montmorency	30,068	6,510	Sand and gravel, petroleum.
Muskegon	1,668,065	1,939,149	Sand and gravel, salt, petroleum.
Newaygo	399,436	344,179	Petroleum, sand and gravel, stone.
Oakland	5,617,678	5,937,115	Sand and gravel, peat, petroleum.
Oceana	891,202	918,126	Petroleum, sand and gravel, stone.
Ogemaw	1,971,834	1,662,265	Petroleum, sand and gravel.
Osceola	2,335,279	2,029,208	Petroleum, sand and gravel, stone.
Oscoda	15,895	7,763	Petroleum, sand and gravel.
Otsego	37,679	24,360	Sand and gravel.
Ottawa	2,139,083	2,224,305	Sand and gravel, petroleum, stone.
Presque Isle	(2)	(2)	Stone.
Roscommon	1,311,090	1,258,891	Petroleum, sand and gravel.
Saginaw	(2)	538,465	Clays, petroleum, sand and gravel.
Saint Clair	12,875,153	15,301,753	Salt, cement, peat, petroleum, sand and gravel, clays.
Saint Joseph	(2)	200,538	Sand and gravel, stone, peat.
Sanilac	313,942	660,548	Peat, sand and gravel.
Schoolcraft	(2)	66,476	Sand and gravel.
Shiawassee	299,914	374,799	Sand and gravel, clays.
Tuscola	1,449,806	1,471,003	Sand and gravel, petroleum, peat.
Van Buren	252,069	523,276	Sand and gravel, petroleum, stone.
Washtenaw	1,917,101	1,708,078	Sand and gravel, petroleum, peat.
Wayne	35,582,807	44,269,585	Cement, salt, lime, sand and gravel, stone, clays, petroleum.
Wexford	110,048	63,340	Sand and gravel.
Undistributed[4]	[5] 85,121,028	81,549,203	
Total[6]	[5] 343,487,000	379,244,000	

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[1] Gem stones, natural gas, and natural-gas liquids not listed by counties as data are not available. Value included with "Undistributed."

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Includes value of mineral production in Keweenaw and Ontonagon Counties (1958–59).

[4] Includes value of items references in footnotes [1] and [2] sand and gravel (1958–59), petroleum (1958), and stone (1958–59) not assignable to specific counties.

[5] Revised figure.

[6] Total has been adjusted to eliminate duplicating value of clays and stone.

Marl, for agricultural use, was produced from pits near Dorr, Fennville, and Hopkins.

Sand and gravel, used chiefly for road and building construction, was mined at eight sites.

Alpena.—Portland and masonry cements were produced at Alpena by the Huron Portland Cement Co. The company mined clay and limestone for use in manufacturing cement. During the year the National Gypsum Co., of Buffalo, N.Y., acquired the Huron Portland Cement Co. through an exchange of stock. Huron was to continue as an independent subsidiary, maintaining its own facilities for production, research, and sales. Plans were announced to increase the finish-grind capacity of the mill and to enlarge shipping facilities. Plans for the latter included new silos, a new slip and deeper harbor, and new boatloading facilities.

Building and paving materials were mined at two sand and gravel pits near Alpena.

Antrim.—Clay for use in manufacturing cement at its plant at Petosky was mined by the Penn-Dixie Cement Co. of Nazareth, Pa. Sand and gravel for road use was produced near Mancelona.

Arenac.—The highway commissions of Arenac, Bay, and Iosco Counties operated quarries and produced limestone for road use.

Over 500,000 barrels of petroleum were produced from seven fields. The Deep River field yielded the largest quantity.

Sand and gravel was produced near Omer and Standish.

Baraga.—The Ohio open-pit mine of the Cleveland-Cliffs Iron Co. remained shut down. Last shipments were made in 1957.

Sand and gravel for road use was mined for the county road commission and the State highway department.

Barry.—Four pits yielded sand and gravel for building and road use. The Nashville Gravel Co., Nashville, installed a heavy-medium plant to remove deleterious matter from its product. The upgraded gravel sold at a premium price.

About 25,000 barrels of petroleum, most of it from the Hope field, was produced. Small quantities were reported for the Johnstown and Thornapple fields.

Marl, for agricultural use, was dug at three sites.

Bay.—Portland and masonry cements were produced at Bay City by the Aetna Portland Cement Co.

Lime was produced for use in refining sugar by the Monitor Sugar Division of the Robert Gage Coal Co.

Six oilfields yielded over 650,000 barrels of petroleum; the largest production came from the Kawkawlin field. Crude oil was refined at Bay City by the Bay Refining Corp.

Berrien.—Sand and gravel valued at nearly $1 million was produced at eight sites. Output included a substantial quantity of industrial sand (molding, engine) as well as building and road materials. A small amount of peat was dug at Watervliet. Marl pits were operated near Benton Harbor and Three Oaks.

Branch.—In the Sherwood area five leased marl pits were operated by Case Brothers. Sand and gravel pits near Coldwater yielded building and road materials.

Calhoun.—Development of the Albion-Pulaski-Scipio trend of the Trenton-Black River formation brought the first petroleum production to the county. The Albion field yielded over 341,000 barrels. A total of 55 wells were drilled in the county; 30 produced oil, 1 yielded gas, and 24 were dry holes.

Sand and gravel valued at over $3 million was produced at pits throughout the county. Two-thirds of the total was contracted for by the county road commission and the Michigan State Highway Department.

Marl was dug at three pits near Athens, Burlington, and Union City.

Cass.—Marl pits were operated near Cassopolis and Dowagiac. Sand and gravel pits near Benton Harbor, Cassopolis, and Niles yielded building and paving materials.

Charlevoix.—Charlevoix Lime & Stone Co. at Vanderbilt quarried limestone. Part of the output was sold for rough construction, and the balance was crushed for blast-furnace flux and agriculture. The Michigan State Highway Department contracted for sand and gravel for road construction.

Cheboygan.—Afton Stone & Lime Co. quarried and crushed limestone near Afton for concrete and roadstone. Building and paving materials were mined from sand and gravel pits in the county.

Chippewa.—Drummond Dolomite Inc. quarried limestone on Drummond Island. The crushed material was sold for concrete and roadstone, flux, agriculture, and stone sand. Development of the new company quarry continued. Exploration revealed a large reserve of high-quality dolomite.

Sand and gravel was produced by I. L. Whitehead Co. of Sault Ste. Marie for building and paving use. The county road commission and the Michigan State Highway Department obtained road material from pits in the county.

Clare.—Nearly 500,000 barrels of petroleum was produced at nine fields. The Hamilton and Skeels fields each yielded over 100,000 barrels. Over 350 million cubic feet of natural gas, principally from the North Hamilton and Headquarters fields, was produced.

The Michigan State Highway Department obtained sand and gravel for roads from sites in the county.

Clinton.—Humus peat, for horticulture, was dug from a bog near Ovid by the All-Star Peat Co.

Clay for manufacturing heavy clay products was mined by the Grand Ledge Clay Products Co.

Sand and gravel, principally for building and paving, was obtained from four pits.

Crawford.—The Beaver Creek field produced 171,000 barrels of petroleum and over 0.75 billion cubic feet of natural gas.

Sand and gravel was produced for use in building and maintaining the county and State road systems.

Delta.—Bichler Bros., Escanaba, quarried and crushed limestone for roads. Over 1 million tons of sand and gravel was produced. Much of it was used by the U.S. Army Corps of Engineers in developing airfields on the Northern Peninsula.

Plans were announced by the Northern Peninsula Oil Refining, Inc., to construct an oil refinery in Rapid River. The plant was to refine crude oil from the Trans-Canada pipeline, which traverses the county.

Dickinson.—The M. A. Hanna Co. operated the Groveland open-pit mine, and the low-grade jaspilite ore was shipped to the concentrating plant near Randville.

Pickands Mather & Co. shipped iron ore from the Cornell mine stockpile; the mine remained closed. Bradley open-pit mine was closed and the equipment sold.

Metro-Nite Co., Milwaukee, Wis., operated a limestone quarry near Felch. The material was crushed, shipped to the company mill in Wisconsin, and ground for use in paint and putty.

Superior Rock Products Co., Sagola, operated the Randville limestone quarry and crusher. The output was used for ornamental concrete and terrazzo.

Sand and gravel was produced for the county and State road departments.

Eaton.—Clay for use in manufacturing heavy clay products was mined by American Vitrified Products Co. and Grand Ledge Clay Products Co.

Limestone was quarried near Bellevue by Cheney Limestone Co. Output was sold for concrete aggregate, roadstone, and agriculture. Hilu Peat Co. dug moss peat from a bog near Charlotte.

Sand and gravel was produced at five sites, chiefly for road construction.

Emmet.—Penn-Dixie Cement Corp. (Nazareth, Pa.) produced portland and masonry cements at its plant at Petoskey. The company quarried limestone for its own use.

Genesse.—The Otisville field yielded a small amount of petroleum.

Sand and gravel production was reported by nine operators. Most of the material was used for building and paving.

Gladwin.—Over 500,000 barrels of petroleum was produced from eight fields. The Buckeye North and South fields yielded nearly half the output.

Road materials for the county and State highway departments was produced from sand and gravel pits in the county.

Gogebic.—The North Range Mining Co. mined iron ore from the Penokee underground mine, and Pickands Mather & Co. operated the Geneva-Newport, Peterson, and Sunday Lake mines. The Wakefield mine remained closed.

Limestone was quarried for use by the city of Iron Mountain. Sand and gravel was produced at four pits.

Gratiot.—Michigan Chemicals Co. utilized natural well brines at its St. Louis plant to produce bromine, calcium chloride, magnesium compounds, and salt.

Sand and gravel was produced at six sites.

Petroleum was produced at the Elba and Sumner fields. Leonard Refineries, Inc. operated two plants at Alma for processing crude oil.

Hillsdale.—Continued development of the Scipio oilfield raised petroleum output to nearly 1.5 million barrels, the highest of any county in the State. During the year 38 oil wells were completed.

Marl was dug from a pit near Reading by Lowell Stuckey. At Hillsdale the Canary Hill Stone Quarry, still in the development stage, produced a small quantity of sandstone for flagging. This was one of two areas in the State producing sandstone; the other was the Napoleon area of Jackson County. Sand and gravel was produced at nine sites.

Houghton.—Copper was produced by Calumet & Hecla Inc., Calumet; Copper Range Co., Painsdale; and Quincy Mining Co., Hancock.

Calumet & Hecla, Inc. operated the Ahmeek No. 2, Ahmeek No. 3, Allouez, Centennial No. 2, Centennial No. 3, Osceola No. 13, Peninsula, and Seneca mines. The overall grade of ore mined was slightly higher than in 1958. Development of a new area in the Calumet conglomerate lode was completed during the year, and production, through the Osceola No. 13 shaft, was begun in October. Mining the Kearsage lode through the Ahmeek No. 3 shaft stopped in July, as reserves were exhausted. The Tamarack reclamation plant increased copper production mainly because of an improved grade in the Ahmeek tailing and processing the richer Cliff mine tailings. The Hubbell smelter operated throughout the year, and output increased over 1958.

Copper Range Co. shipped ore from the Champion mine and tailing from Redridge to its Freda mill throughout the year. Concentrate from the Freda mill was processed at the White Pine Co. copper smelter in Ontonagon County.

Quincy Mining Co. operated its tailing reclamation plant. Concentrate was smelted at the Calumet & Hecla, Inc., smelter until March when the Quincy Mining Co. Hancock smelter was put into operation. On October 28 the Hancock smelter was shut down for repairs and to build up stocks of concentrate. The smelter was reopened the latter part of November.

The Limestone Mountain Co., Hancock, quarried and crushed limestone for agriculture.

The Houghton County Road Commission quarried basalt for use as concrete aggregate and roadstone. Sand and gravel pits in the county yielded materials for road construction.

Huron.—The Wallace Stone Co., at Bay Port, quarried limestone. Most of the output was crushed for use as concrete aggregate, roadstone, railroad ballast, and aglime. Some rough construction stone also was quarried.

Sand and gravel was mined from five pits and used principally for road construction.

A small quantity of petroleum was produced from the Dwight and Grant fields.

Ingham.—The Lansing Board of Water and Light operated a calcining plant at its water-treatment plant and produced lime. Calcium carbonate, precipitated in the water purification process, was used as raw material.

Peat for horticulture was dug from two bogs near Lansing and Delhi.

Sand and gravel valued at over $1 million was produced at 12 pits throughout the county.

Ionia.—The Hubbardston oilfield was abandoned during the year. A small quantity of petroleum was produced from the Ionia County section of the Bloomer field.

Sand and gravel production was substantially smaller, as road contracts in the county were completed and portable plant operators moved elsewhere.

Iosco.—National Gypsum Co. operated a gypsum mine near Tawas City and a gypsum processing plant at National City. The company also mantained port facilities on Tawas Bay for shipping crude gypsum and finished products to plants at Waukegan, Ill., and Lorain, Ohio.

United States Gypsum Co. operated a mine at Alabaster.

Sand and gravel was produced for the county and State highway departments.

Iron.—Because of the 116-day steel strike iron-ore shipments were about one-third less than in 1958. Iron ore was produced at eight underground mines. The M. A. Hanna Co. operated the Cannon, Hiawatha, Homer, and Wauseca mines. The new 20-ft. circular 2,740-ft. shaft, serving the Homer and Wauseca mines, was placed in operation. Inland Steel Co. operated the Bristol and Sherwood mines. Pickands Mather & Co. produced from the Buck Unit mine and Republic Steel Corp. from the Tobin Group. The Book mine of North Range Mining Co. was idle.

Sand and gravel was produced for the county and State highway departments.

Isabella.—The county remained the second largest petroleum producer in the State. Over 850,000 barrels of petroleum was recovered from nine fields. The Coldwater field yielded nearly three quarters of this total. Most of the 320 million cubic feet of natural gas produced in the county came from this field. Leonard Refineries, Inc., refined crude oil at Mt. Pleasant.

Marl was dug from pits near Mt. Pleasant and Weidman. Building and paving sand and gravel was produced at three sites.

Jackson.—The Pulaski field yielded over 208,000 barrels of petroleum—the first production in the county since 1956. Cumulative production before 1959 was only 6,437 barrels.

Development of the Albion-Pulaski-Scipio trend in Calhoun, Hillsdale, and Jackson Counties was responsible for record production in the county in 1959. Sixteen oil wells and one gas well was completed. The gas well, with an indicated production of 17 million cubic feet per day, was shut in.

Jeffrey Limestone Co. of Parma quarried and crushed limestone for use in concrete aggregate, roadstone, and aglime.

In the Napoleon area three sandstone quarries yielded flagging, rubble, and rough construction stone.

Marl pits were operated near Hanover and Horton.

Sand and gravel was produced at six sites and used chiefly for building and road construction.

Kalamazoo.—Bogs near Kalamazoo and Scotts yielded reed-sedge and moss peat, which was sold for horticulture.

Marl, for soil conditioning, was dug from five pits.

A small amount of petroleum was produced from the Alamo field. Crude oil was refined at Kalamazoo by the Lakeside Refining Co.

About 1 million tons of sand and gravel was produced, mostly for highway construction.

Kalkaska.—Petroleum was recovered from the Beaver Creek and Excelsior fields. Road materials were obtained from sand and gravel pits for use by the county and State highway departments.

Kent.—Gypsum was mined and processed in plants in the Grand Rapids area by Bestwall Gypsum Co. and Grand Rapids Plaster Co. The finished products included wallboard, lath, sheathing, and plaster.

About 150,000 barrels of petroleum was produced from the Rockford, Walker, and Wyoming Park fields.

Moss, humus, and reed-sedge peat was dug from four bogs near Grand Rapids and Sparta.

Nearly 1.9 million tons of sand and gravel was produced at 15 sites. The Grand Rapids Gravel Co. acquired the H. F. Postma Gravel Co. which had been operating in the area for 30 years.

Lake.—A small quantity of petroleum was recovered from the Chase, Reed City, and Sauble fields. Sand and gravel for use in road construction was produced for the county and State highway departments.

Lapeer.—The Wilkinson Chemical Co., at Mayville, recovered calcium chloride from natural well brines.

Humus peat, for horticulture, was dug from bogs near Almont and Imlay City.

Sand and gravel was produced at three sites.

Lenawee.—General Portland Cement Co. produced portland and masonry cements at Cement City. Consolidated Cement Co. merged with General Portland Cement Co. and its Cement City plant became the Peninsular Portland Cement Division of General Portland Cement Co. The new company, with plants in Florida, Kansas, Ohio, Tennessee, and Texas, as well as Michigan, was one of the largest cement manufacturers in the United States. Clay was mined at Tecumseh by Comfort Brick & Tile Co. and near Rollin by Peninsular Portland Cement Division of General Portland Cement Co. Output was used in the manufacture of draintile and cement.

Moss and humus peat was produced from a bog near Tecumseh by Frank Mason.

Sand and gravel was produced at six sites.

Mackinac.—Inland Lime and Stone Company milled and shipped crushed limestone at Port Inland in Schoolcraft County. The limestone was quarried in adjoining Mackinac County and moved by privately owned railroad to the mill and port. Michigan Limestone Division of U.S. Steel Corp. quarried and milled limestone at Cedarville. The company maintained port facilities at nearby Port Dolomite. The Thornton Construction Co. quarried limestone from the Hendricks quarry near Garnet. Nearly all crushed limestone produced in the county was shipped by boat to consumers for use as flux, concrete aggregate and roadstone, and for agriculture.

Sand and gravel was produced at four sites.

Macomb.—Humus peat was produced from a bog near Mt. Clemens by Soulliere Nursery. It was used for horticulture.

Over 1.5 million tons of sand and gravel was mined by 16 operators. It was used mainly for building and road construction.

Manistee.—Bromine and magnesium compounds were recovered from natural brines drawn from the Filer sandstone formation. Chemical plants were operated by Great Lakes Chemical Corp., Michigan Chemical Corp., Morton Chemical Co., and Standard Lime and Cement Co.

Salt was extracted from artificial brines, produced by dissolving salt from the Detroit River formation, by Manistee Salt Works and Morton Salt Co.

Sand and gravel was produced for industrial purposes as well as building and paving.

Marquette.—Iron-ore production was reported from 10 underground mines and 3 open pits. Cleveland-Cliffs Iron Co. operated six underground and two open-pit mines. Jaspilite ore mined from the Republic open pit was concentrated at the Republic concentrator and pelletized at the Eagle Mills plant. The Humboldt Mining Co. (a joint venture of Cleveland-Cliffs Iron Co. and Ford Motor Co.) had under construction an iron-ore pelletizing plant with a capacity of 2,000 tons of iron-ore concentrate per day.

Underground mines were operated by Inland Steel Co. (Greenwood and Morris), Jones & Laughlin Steel Corp. (Tracy), and North Range Mining Co. (Jackson). Pickands Mather & Co. operated the Volunteer-Maitland open-pit mine. About 65 percent of the iron ore shipped from the county was direct-shipping grade, and the balance was beneficiated.

Over 500,000 tons of sand and gravel was mined from pits in the county. Output was used as engine sand and fill and for building construction and highway maintenance.

Mason.—Bromine, calcium chloride, and magnesium compounds were extracted from natural brines in the Ludington area by the Dow Chemical Co. The company also produced lime for industrial uses and chemical processing. A new limekiln, which will substantially increase present capacity, was under construction at yearend.

Harbison-Walker Refractories Co. produced refractory magnesia near Ludington.

About 250,000 barrels of petroleum was recovered from four fields; the Eden and Riverton fields supplied the major portion of the output. Sand and gravel pits in the county provided building and road materials as well as sand for industrial uses.

Mecosta.—Marl pits near Blanchard and Mecosta yielded marl for agriculture. Sand and gravel for road construction was produced.

Petroleum was recovered from four fields and natural gas from eight fields.

Menominee.—Limestone Products Division of Northwestern-Hanna Fuel Co. produced lime for chemical and industrial purposes. Sand and gravel was produced from several pits for building and paving use.

Midland.—The Sylvania formation yielded brines, which were processed by the Dow Chemical Co. for manufacturing bromine, calcium chloride, magnesium compounds, and potash. The company also produced salt from artificial brines. The Dow Chemical Co. had developed a process to convert molten slag from wet-bottom slag-top boilers to a lightweight aggregate material. The process was marketed under the trademark Dowlite.

Kaiser Aluminum and Chemical Corp. was constructing a refractory magnesia plant at Midland. Production was scheduled in 1960. The multimillion dollar plant was to process magnesium hydroxide purchased locally. Output was to supply the company refractories plant in Ohio.

Molding sand and road materials were obtained from pits in the county.

Over 300,000 barrels of petroleum was recovered from seven fields. The Porter field was the major producer.

Missaukee.—Marl for agriculture was produced by C. Stanley Hooker near Cadillac. Sand and gravel was produced for use by the Michigan State Highway Department. Over 450,000 barrels of petroleum was produced from 5 fields. The East Norwich field contributed 274,000 barrels as well as 206 million cubic feet of natural gas.

Monroe.—F. W. Ritter & Sons Co. manufactured pottery from clay mined near South Rockwood. Peat for horticulture was dug from bogs near Ida and Petersburg. Limestone was quarried near Monroe and Ottawa Lake; output was crushed mainly for concrete aggregate and roadstone. Sand and gravel was produced for the Michigan State Highway Department. A small quantity of oil was recovered from the Deerfield and Summerfield fields.

Toward yearend the Dundee Cement Co. completed a cement plant, which was to utilize a large deposit of clay and limestone near the site for raw materials. The $26 million plant will have an annual capacity of 6 million barrels of cement. The plant has two kilns (15/16.5 by 460 ft.) and five two-compartment tube mills (12 by 36 ft.), two are slurry mills, and three are finish cement mills.

Montcalm.—Nearly 800,000 barrels of petroleum, the third largest output in the State, was produced from nine fields. The Reynolds (558,000 barrels) and Edmore fields (108,000 barrels) had the largest output. At Carson City the Crystal Refining Co. refined crude oil.

Moss and reed-sedge peat were dug from a bog near Lakeview by Summer's Michigan Peat Co.

Several sand and gravel pits yielded building and paving materials.

Montmorency.—The Atlanta field yielded a small amount of petroleum. Building and road materials were obtained from sand and gravel pits in the county.

Muskegon.—Hooker Electrochemical Co. produced salt from artificial brines near Montague.

Petroleum was produced at five fields.

Over 750,000 tons of sand and gravel was obtained from pits in the county. Substantial quantities of industrial sand and building and road materials were produced.

Crude oil was refined at Muskegon by Naph-Sol Refining Co. and the Ohio Oil Co.

Newaygo.—A pit near Grant yielded marl for agriculture.

Sand and gravel was also produced.

Nearly 100,000 barrels of petroleum was produced from seven fields.

The Ensley field was abandoned, and the Reeman field was put into commercial production with three wells producing at yearend.

Oakland.—Nearly 6.5 million tons of sand and gravel was produced from 23 sites. Most of the material was used for highways and buildings.

Humus peat valued at over $125,000 was dug from six bogs.

A small amount of petroleum was produced in the Northville field.

Oceana.—Marl was produced from a pit near Hart.

Sand and gravel pits yielded road materials for the Michigan State Highway Department.

Seven fields produced 308,000 barrels of petroleum; Crystal Valley, Pentwater, and Stony Lake fields led in output. The Mears field was abandoned.

Ogemaw.—Over 500,000 barrels of petroleum, mainly from Rose City and West Branch fields, was recovered. The Rose City field also produced 800 million cubic feet of natural gas. West Branch Refineries, Inc., at West Branch refined crude oil.

Sand and gravel was produced at three sites.

Ontonagon.—The White Pine Copper Co. (a wholly-owned subsidiary of the Copper Range Co.) operated its mine, mill, and smelter until October 28 when it was closed by a strike, which was not settled by yearend. Consequently, milled production of copper ore and concentrate decreased.

A substantial copper-bearing ore body was discovered on land owned by the Copper Range Co. Intensive drilling confirmed that the ore was the same type as that mined at White Pine. It was estimated that the ore body contained 50 million tons of ore having more than 30 pounds of copper per ton. In an adjoining company-owned area a previously drilled ore body was estimated to contain 55 million tons. The combined ore bodies were estimated to average 26 pounds of copper per ton.

Road materials were obtained from sand and gravel pits.

Osceola.—Marl was produced from leased pits by C. Stanley Hooker. Road material was produced from sand and gravel pits.

Petroleum (611,000 barrels) was produced from nine fields; Reed City and Reed City East fields yielded more than 500,000 barrels. The Burdell field was opened for production. Nearly 500 million cubic feet of natural gas was produced from four fields, and most of the output was oil-well gas from the Reed City field. The Osceola Refining Co. refined crude oil at Reed City.

Oscoda.—The Mio field yielded a small quantity of petroleum.

Sand and gravel was produced for the Michigan State Highway Department.

Ottawa.—Over 1.75 million tons of sand and gravel was produced at seven operations. Construction Aggregates Corp. produced industrial sand from Lake Michigan dune sands and building and road materials from sand and gravel deposits on the Grand and Bass Rivers. Material was processed at a plant in Ferrysburg. Other operators produced building and road materials and industrial sands from deposits near Grand Haven, Hudsonville, and Zeeland. A major portion of the county output was shipped by water to consumers in other areas. A pit near Denison yielded marl for agriculture.

Petroleum was obtained from five fields; Walker field produced 175,000 of the 183,000 barrels recovered.

Presque Isle.—One of the largest limestone quarries in the United States was operated by Michigan Limestone Division of United States Steel Corp. at Rogers City. The quarry was a major tourist attraction, and nearly 50,000 visitors annually used the lookout station provided by the company. The Chemstone Co. operated a large limestone quarry for the Presque Isle Corp. at Presque Isle. The output of both quarries was crushed and shipped, chiefly by water, to consumers in the Great Lakes area. The crushed limestone was used for flux, concrete aggregate and roadstone, agriculture, chemical and other industrial uses, and in manufacturing cement and lime.

The Onaway Stone Co. quarried dimension limestone near Onaway. Part of the output was milled for use as sawed stone and flagging, and the balance was shipped as rough construction stone and rubble.

Roscommon.—Petroleum (314,000 barrels) and natural gas (1.2 billion cubic feet) were produced. Principal production of both oil and gas came from Headquarters and St. Helen's fields.

Road materials were produced from sand and gravel pits.

Saginaw.—Clay was mined for use in manufacturing cement and refractories and as a filler.

Road materials were produced from sand and gravel pits.

Petroleum was recovered from five fields. Birch Run field produced the major portion.

St. Clair.—Peerless Cement Co., division of American Cement Corp., produced portland cement at Port Huron and mined clay used in its manufacture.

Salt was produced from artificial brines at Marysville by Morton Salt Co. and at St. Clair by Diamond Crystal Salt Co. In March the latter company changed one brine well to a hydrofracting process and reported that the new technique of salt extraction was proving satisfactory.

Michigan Peat Inc. produced peat from a bog near Capac.

Sand and gravel, used mainly for road materials and building construction, was mined at seven pits.

Petroleum was produced at four fields. A major portion of the 335,000 barrels came from the Peters field. The China field, with one well in operation, began production.

Natural gas was produced at three fields (532 million cubic feet). The Boyd and Ira fields supplied most of the output.

St. Joseph.—Moss peat was dug from a bog near Three Rivers. Marl for agriculture was produced in the same area by Coy Drake and Robert Bros.

Sand and gravel was produced for road construction and building materials.

Sanilac.—Peat valued at over $500,000 was the major mineral commodity produced. Bogs near Miden City and Sandusky yielded moss and reed-sedge peat, used chiefly for horticulture.

Sand and gravel was produced at three pits.

Shiawassee.—Michigan Vitrified Tile Co. mined miscellaneous clay at Corunna for use in manufacturing heavy clay products.

Sand and gravel was produced at five sites. Output was used mainly for building and paving purposes.

Tuscola.—Rushland Peat Co. at Caro produced moss peat for horticulture.

Nearly 141,000 barrels of petroleum was produced at five fields.

Seventeen sand and gravel pits throughout the county yielded over 1 million tons of material. Molding sand and building and paving sand and gravel were produced.

Van Buren.—Marl was dug from a pit near Paw Paw by Clarence Harter.

Industrial sands and road materials were produced at five sand and gravel pits.

Petroleum was recovered at four fields, with the Bloomingdale field yielding the greatest amount.

Washtenaw.—Petroleum was produced at the Northville field, which also yielded over 500 million cubic feet of natural gas.

Peat bogs near Salem and Ypsilanti yielded moss and reed-sedge peat for horticulture. Over 1.8 million tons of sand and gravel was produced at nine sites. It was used mainly for building and paving.

Wayne.—Wayne County continued to lead in the value of mineral commodities produced—cement, clay, lime, petroleum, salt, sand and gravel, and stone. Natural gas, the value of which is not available on a county basis, also was produced.

Peerless Cement Co., division of American Cement Corp., operated two plants and produced portland and masonry cements and clay used in manufacturing cement. Wyandotte Chemicals Corp., at Wyandotte, produced portland cement.

Flat Rock Clay Products Co. manufactured draintile from clay mined near Flat Rock.

Light Weight Aggregates Corp. mined clay at its lightweight aggregate plant site near Livonia. The company described its process of manufacturing lightweight aggregate from clay as follows: After the clay is mined by the open-pit method, it is screened and crushed. Then a closely controlled amount of solid fuel is added to the processed material and blended in a rotary mixer. Water is added to pelletize the blend to proper consistency for sintering.

The pelletized material is deposited on the moving grate of the sintering machine, and in the first few feet it passes under an ignition hood where it is ignited. As it travels along the machine, continuous ignition is supported by a powerful vacuum. During the burning process the mass is heated to the point of incipient fusion, where it becomes plastic and emits gases that blast it into a cake of nonconnected air cells. The bloated material is discharged from the sintering machine to a vibrating grizzly where loose and underburned particles are removed and returned for reburning. The sintered material is in clinker form with a temperature of about 2,300° F. Next the clinker is dropped into a cooling pit. After cooling, the material is passed to a crushing plant where it is reduced to aggregate sizes to meet specifications. The company sold its output to fabricators of lightweight aggregate materials.

Hydrated lime was produced at Wyandotte by Wyandotte Chemicals Corp. Most of the output was used in manufacturing chemicals.

Salt was produced from an underground mine by International Salt Co. in Detroit. The company experimented with a continuous-mining machine.

At Wyandotte, Pennsalt Chemicals Corp. and Wyandotte Chemical Corp. produced salt from artificial brines.

Limestone was quarried from the Sibley quarry at Trenton by Ed. Kraemer & Sons for the Michigan Foundation Quarry Co., Inc. The 130-year-old quarry was owned by the Detroit Edison Co., and part of it was used as a dump for fly ash from Detroit Edison's Trenton plant. The limestone was crushed and used mainly for parking lots and driveways. At Flat Rock the Huron River Quarry, Inc., produced crushed limestone.

Over 2.2 million tons of sand and gravel was mined from pits. Sand for industrial use (molding, glass, blast) and sand and gravel for fill and building and road materials were produced.

The Northville field yielded a small quantity of petroleum and 677 million cubic feet of natural gas.

Byproduct sulfur was produced from crude petroleum by Aurora Gasoline Co., a division of the Ohio Oil Co., in Detroit. Crude oil also was refined by Petroleum Specialities Inc. at Flat Rock and by Socony-Mobil Oil Co. at Trenton.

The Mineral Industry of Minnesota

By Matthew G. Sikich[1]

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PRINCIPAL reason for the 12-percent decrease in total value of Minnesota mineral output in 1959 was a 116-day work stoppage in the iron-ore mining industry. Minerals produced in the State were valued at $347 million, compared with $396 million in 1958.

Minnesota ranked first in the Nation in iron-ore production and supplied 61 percent of the total usable ore shipped from mines in the United States. However, shipments of iron ore from Minnesota mines were the lowest in 20 years because of a midseason strike, which began July 15. According to the Minnesota Employment Security Division, approximately 30,000 workers were idled by the strike, including nearly 20,000 miners, Great Lakes seamen, and metalworkers involved directly in the dispute. The strike was interrupted by a Taft-Hartley Act injunction, upheld by the Supreme Court November 7, ordering the strikers back to work for an 80-day period. Extreme cold weather during most of November hampered loading operations, but favorable weather conditions in December permitted Lake shipments to continue to the latest date in the history of Minnesota ore movement.

Iron-bearing ores (including those containing 5 to 35 percent manganese, natural) comprised about 89 percent of the State total mineral value. Nonmetals furnished the remainder. Decreases in total value of production were recorded for all mineral commodities except clays, lime, and manganiferous ore. Although total value of stone produced in the State decreased from 1958, quantity of output increased nearly 4 percent and established a record high. Output of clays increased considerably (also setting a new record) because of the new lightweight-aggregate plant of North Central Lightweight Aggregate Co., Inc., in Hennepin County.

EMPLOYMENT AND INJURIES

Approximately 27.4 million man-hours was worked in Minnesota mineral industries in 1959, excluding office workers. This represented a 16-percent decrease from the final figure of 32.5 million man-hours recorded for 1958. The decrease was attributed chiefly to the prolonged steel strike in 1959, resulting in a drop of 3.5 million man-hours worked in the State iron-ore mining industry.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

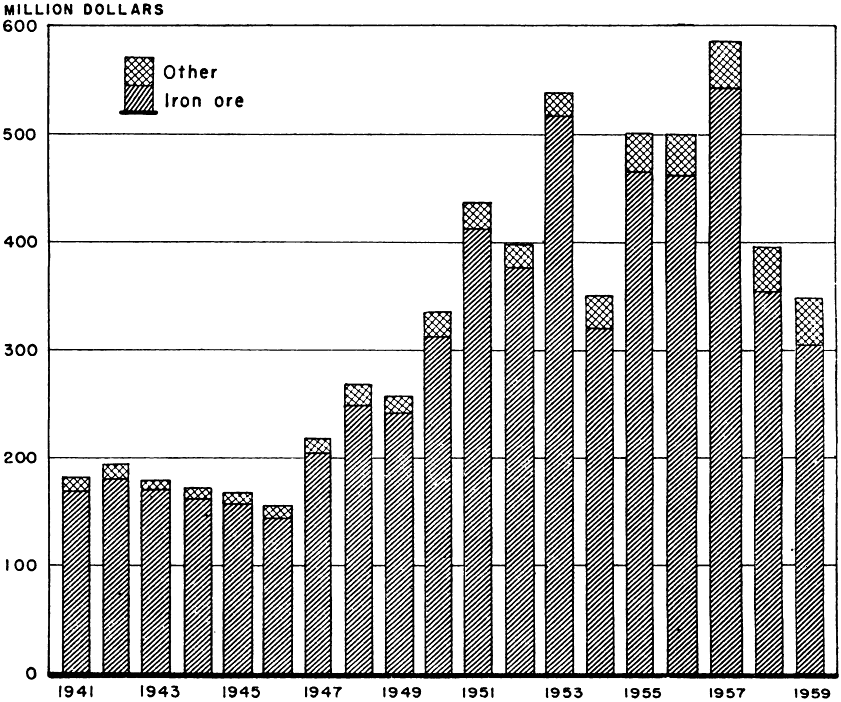

FIGURE 1.—Value of iron ore shipments and total value of all minerals produced in Minnesota, 1941–59.

TABLE 1.—Mineral production in Minnesota[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	92	$150	153	$267
Iron ore (usable) ____thousand long tons, gross weight	42, 502	354, 528	36, 109	306, 920
Manganiferous ore (5 to 35 percent Mn) __gross weight	371	(2)	429	(2)
Sand and gravel	29, 634	21, 680	28, 486	20, 726
Stone	3, 519	9, 560	3, 639	9, 461
Value of items that cannot be disclosed: Abrasive stones, cement, gem stones, lime, peat (1958), and values indicated by footnote 2		10, 154		9, 993
Total Minnesota[3]		395, 880		347, 178

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Total adjusted to eliminate duplicating value of stone.

Seven fatalities—four in the iron-mining industry, two at limestone quarries, and one at a lime plant—occurred in 1959, compared with only one in 1958. Total number of nonfatal disabling injuries decreased from 432 to 398.

The Rouchleau mine of Oliver Iron Mining Division, United States Steel Corp. won the Sentinels of Safety trophy, the highest award, in the open-pit group of the 1959 National Safety Competition. The mine, located near Virginia, worked 627,409 man-hours during 1959 without a disabling work injury. Many other mines and plants in the State experienced injury-free records in 1959 and received Certificates of Achievement in Safety awarded by the Federal Bureau of Mines.

All employment and injury data were collected from operating companies on a voluntary basis. Data represent virtually complete coverage of the State mineral industry.

LEGISLATION AND GOVERNMENT PROGRAMS

General distribution of the "Copper-Nickel Mining Unit Book," prepared by the Minnesota Division of Lands and Minerals, was delayed pending approval by the State Executive Council of rules and regulations governing leases on State-owned land for exploration of copper-nickel deposits. Approval was expected about mid-1960. Approximately 120,000 acres of land in Cook, Lake, and St. Louis Counties was involved.

An act relating to taxation of semitaconite, and the mining and beneficiation thereof, was passed by the 1959 Minnesota Legislature. The new law and the 1941 act relating to taxation of taconite were expected to encourage the development of the enormous taconite and semitaconite deposits of the Mesabi Range.

Construction of a new $1.7 million Federal Bureau of Mines research center at Fort Snelling was completed in November. The center will be headquarters for Bureau mining, metallurgical, and other mineral-industries research and resource activities—primarily in the North Central States.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—The major strike of the steel industry (July 15–November 7) was responsible for Minnesota iron-ore shipments dropping to the lowest point since 1939. Shipments totaled 36.1 million long tons, a 15-percent decrease from 1958. The 116-day strike forced a shutdown of all but a few iron-ore mines and beneficiating plants in the State. Shipments during the normally peak operating period were virtually nil. Most of the railroads handling ore and the ore-carrier fleet plying the Great Lakes curtailed or suspended transportation of ore. On November 7 strikers were ordered back to work for at least 80 days by Federal Court order. However, many mines remained closed because of the cold weather, which usually forced most concentrating plants to close the latter part of October. Adverse weather conditions hindered shipments in November. Shortages of ore at consuming furnaces dependent on Minnesota ore were averted for the most part by unseasonably warm weather in December, which permitted Lake shipments to continue to December 20 and contributed to the heaviest December Lake shipments on record. At the close of the year Erie Mining Co. announced plans to ship taconite concentrate pellets by rail during the winter season at the rate of 15 cars, approximately 750 tons, a day. Pellets were to be shipped to Interlake Iron Corp. furnaces at Chicago.

Iron ore was shipped by 24 companies operating mines in Crow Wing, Fillmore, Itasca, and St. Louis Counties. Shipments from the Mesabi Range (in Itasca and St. Louis Counties) constituted 94 percent of the State shipments of usable iron ore. Mines in the Cuyuna Range in Crow Wing County, the Vermilion range in St. Louis County, and the Spring Valley district in Fillmore County supplied the remainder. Approximately 64.5 million tons of crude ore was mined. Open-pit mines furnished 98 percent of the crude material; underground mines the remainder. Over 74 percent of the crude ore was beneficiated. Concentrate comprised 55 percent of the total usable ore shipped; direct-shipping grades furnishing the remainder. (Crushed, screened, and sized ores not further treated are considered as direct-shipping material.) Average iron content of usable ore produced in Minnesota was 54.1 percent, natural, compared with 54.0 percent in 1958.

Shipments of taconite concentrate were 8.4 million tons, constituting 23 percent of the total usable ore output. Companies operating taconite mines and processing plants in 1959 were Erie Mining Co. (operating agent, Pickands Mather & Co.), Reserve Mining Co., and Oliver Iron Mining Division of United States Steel Corp.

The M. A. Hanna Co. continued development at the Pierce mine near Hibbing. Over 2.5 million cubic yards of overburden was moved at this property. Crushing and screening units, conveyor systems, and other plant facilities were under construction. Initial shipments from the Pierce, scheduled originally for 1959, were delayed by the prolonged strike and were to begin in 1960. First shipments since 1925 were made from the company Robert mine in the Cuyuna Range.

The Zenith underground mine at Ely was reopened in the spring by Zenith Mining Co., jointly owned by North Range Mining Co. and W. S. Moore Co. A new washing plant was constructed at Zenith to process minus-1¼-inch material.

Jones & Laughlin Steel Corp. continued development at its Lind-Greenway mine at the western end of the Mesabi Range near Grand Rapids. Construction of a new concentrator at the mine was near completion at yearend. Production was scheduled for 1960.

Oliver Iron Mining Division of United States Steel Corp. announced plans for constructing a new beneficiation plant adjacent to the company Sherman ore-sizing plant near Chisholm. The plant will treat ores from the Monroe and Sherman mine groups and will include a washing plant with scrubbers and heavy-medium and spiral units.

Inland Steel Co. began using a new production shaft at its Armour No. 2 property in the Cuyuna Range. Armour No. 1 shaft was to be abandoned.

Virtually all the iron ore shipped from Minnesota was used in manufacturing pig iron and steel. Nearly 6,000 tons was used in heavy-medium concentration, and a small quantity was sold for use in manufacturing cement.

Approximately 97 percent of Minnesota ore shipments was hauled by rail from the mines to Lake Superior harbors, transported by vessel to the lower lake ports, and thence to consuming districts. The remainder was shipped entirely by rail to consumers. Minnesota iron ore was consumed at Duluth in blast and steel furnaces operated by Interlake Iron Corp. and the American Steel & Wire Division of

TABLE 2.—Dates of first and final cargoes of iron ore at United States upper Great Lakes ports [1]

Port and dock	1957		1958		1959	
	First	Final	First	Final	First	Final
Ashland, Wis.:						
C & NW	Apr. 28	Nov. 23	May 18	Nov. 20	Apr. 24	Nov. 18
Soo Line	Apr. 28	Nov. 23	May 18	Nov. 20	Apr. 24	Nov. 18
Duluth, Minn.: DM & IR	Apr. 9	Nov. 11	May 17	Oct. 26	Apr. 23	Dec. 17
Escanaba, Mich.: C & NW	Apr. 1	Nov. 29	May 1	Dec. 5	Apr. 10	Dec. 8
Marquette, Mich.:						
DSS & A	May 17	Oct. 21	June 10	Oct. 27	Apr. 27	Dec. 4
LS & I	Apr. 27	Nov. 26	Apr. 26	Dec. 7	Apr. 24	Dec. 12
Silver Bay, Minn.: Reserve	Apr. 10	Nov. 19	Apr. 26	Nov. 27	Apr. 20	Dec. 14
Superior, Wis.:						
GN	Apr. 17	Dec. 3	May 2	Dec. 1	Apr. 17	Dec. 20
NP-Soo Line	Apr. 21	Oct. 30	May 11	Nov. 29	Apr. 27	Nov. 29
Taconite Harbor: Erie	Sept. 26	Nov. 19	May 6	Nov. 29	Apr. 20	Dec. 14
Two Harbors, Minn.: DM & IR	Apr. 9	Nov. 23	May 14	Nov. 19	Apr. 14	Dec. 20

[1] Skillings' Mining Reviews, 1958 and 1959.

TABLE 3.—Usable iron ore produced (direct-shipping and all forms of concentrate), by ranges in thousands of long tons [1]

Year	Cuyuna	Mesabi	Vermilion	Spring Valley district	Total
1950-54 (average)	2,380	62,967	1,595	328	67,270
1955	2,771	64,860	1,454	271	69,356
1956	2,242	59,346	1,285	350	63,222
1957	2,018	64,537	1,349	382	68,286
1958	1,119	39,833	1,027	241	42,221
1959	745	33,747	809	576	35,877

[1] Exclusive of iron ore containing 5 percent or more manganese.

TABLE 4.—Production, shipments, and stocks of usable iron ore, by counties and ranges, in thousands of long tons [1]

County or range	Stocks Jan. 1, 1959	Production	Shipments	Stocks Dec. 31, 1959	Iron content of production
County:					
Crow Wing	191	745	856	79	367
Fillmore	----------	576	576	----------	271
Itasca	755	7,031	7,375	411	3,778
St. Louis	1,676	27,525	27,302	1,899	14,995
Total [2]	2,622	35,877	36,109	2,390	19,412
Range:					
Cuyuna	191	745	856	79	367
Mesabi	2,315	33,747	33,937	2,125	18,306
Vermilion	117	809	740	185	468
Spring Valley district	----------	576	576	----------	271
Total [2]	2,622	35,877	36,109	2,390	19,412

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Data do not add to totals shown because of rounding.

TABLE 5.—Production, shipments, and stocks of crude ore, by counties and ranges, in thousands of long tons [1]

County or range	Stocks Jan. 1, 1959	Production		Shipments		Stocks Dec. 31, 1959
		Under-ground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Crow Wing	44	191	673	575	306	27
Fillmore			876		876	
Itasca			16,731	487	16,245	
St. Louis	837	1,135	44,907	15,133	30.597	1.150
Total [2]	881	1,326	63,188	16,195	48,024	1,176
Range:						
Cuyuna	44	191	673	575	306	27
Mesabi	720	268	61,638	14,949	46,755	923
Vermilion	117	867		671	86	227
Spring Valley district			876		876	
Total [2]	881	1.326	63,188	16,195	48,024	1,176

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Data do not add to totals shown because of rounding.

TABLE 6.—Salient statistics of iron ore shipped from mines in Minnesota, in thousands of long tons [1]

Year	Crude ore to concentrators	Beneficiated			Total usable ore [2]	Proportion of beneficiated to total usable ore (percent)
		Agglomerates	Other	Total		
1950–54 (average)	41,102	729	20,277	21,006	67,151	31.28
1955	50,734	1,793	23,988	25,781	69,419	37.14
1956	59,425	5,309	21,948	27.257	62,637	43.52
1957	68,439	6,836	23,539	30,375	67,656	44.90
1958	55,224	8,829	14,460	23,289	42,502	54.79
1959	48.024	8.401	11,513	19,914	36,109	55.15

[1] Exclusive of ore containing 5 percent or more manganese.
[2] Direct-shipping and beneficiated ore.

United States Steel Corp. Coke ovens also were operated at Duluth by these companies.

Navigation season for ports shipping Minnesota ores opened April 14 at Two Harbors. Virtually all shipments were suspended during a midseason strike. Shipments were resumed after November 7 but were seriously hampered throughout most of November by extreme cold weather. The November freeze retarded ore loading as much as a week just when there was a determined drive to prevent an ore shortage at consuming furnaces during the winter. However, abnormally mild weather in December permitted shipping to continue until December 20, the latest date in the history of Minnesota ore shipments. The last cargo of the season left Two Harbors December 20 and cleared the Soo Locks December 21. December shipments of iron ore from the entire Lake Superior region were over 3 million tons—the greatest on record. All-rail shipments of taconite concentrate pellets began the latter part of December and were expected to continue during the winter months to supplement stocks of ore at Chicago furnaces.

Lake Erie base prices for iron ore were unchanged from 1958. Average weighted mine value for Minnesota ore was $8.50 a long ton, compared with $8.34 in 1958.

The Minnesota Legislature passed a law to encourage development of semitaconite deposits in the Mesabi Range. Chief provision of this "semitaconite" tax law is a tax on merchantable concentrate produced from semitaconite material (agglomerated in Minnesota) of 5 cents per gross ton plus one-tenth of a cent per ton for each percent that the iron content (dry) exceeds 55 percent. For other concentrates produced from semitaconite deposits, the law provides for a tax of 10 cents per gross ton of merchantable concentrate plus one-tenth of a cent per ton for each one-half percent iron content (dry) exceeding 55 percent. The tax would be in addition to the occupation and royalty taxes but in lieu of other taxes. The law defined semitaconite as altered iron formation, altered taconite, ferruginous chert, or ferruginous slate, which has been oxidized and partially leached, and in which the iron oxide is so finely disseminated that substantially all iron-bearing particles of merchantable grade are smaller than 20-mesh and not merchantable as iron ore in its natural state. Further, it cannot be made merchantable by simple methods of beneficiation involving only crushing, screening, washing, jigging, heavy-medium separation, spirals, cyclones, drying, or any combination thereof.

Statistical data for iron ores containing 5 percent or more manganese, natural, are not included with iron ore data in this chapter but are treated separately as "manganiferous ore."

Manganiferous Ore.—Shipments of manganiferous ore (containing 5 to 35 percent manganese, natural) increased 16 percent in 1959 in spite of the prolonged strike in the steel industry. Total shipments were 429,102 short tons, consisting of 151, 566 tons of direct-shipping grade and 277,536 tons of concentrate. Approximately 81 percent of the 947,330 tons of crude manganiferous ore mined was beneficiated. Manganiferous iron ore (containing 5 to 10 percent manganese, natural) constituted 71 percent of the total shipments. Ferruginous manganese ore (containing 10 to 35 percent manganese, natural) provided the remainder. Average natural manganese content of the total shipments was 7.95 percent compared with 7.16 percent in 1958.

Total value of manganiferous ore shipped from Minnesota increased 12 percent from 1958. Ores containing over 5 percent manganese, natural, have generally been priced as Old Range non-Bessemer on the combined natural iron and manganese content, plus a premium for the natural manganese exceeding 5 percent.

Shipments of manganiferous ore came from 11 mines in Crow Wing County, in the Cuyuna Range. Companies producing during the year were The M. A. Hanna Co., Pickands Mather & Co., and Pittsburgh Pacific Co., (Zontelli Brothers Division). Output was mostly for use in blast or steel furnaces. Some was sold to Manganese Chemicals Corp., which processed the material at its chemical plant at Riverton. The company utilized an ammonium carbamate process to produce manganese carbonate. Some manganese carbonate was converted to manganese dioxide and other manganese chemicals. Less than 100 short tons of manganiferous ore was reported sold for use in paint.

TABLE 7.—Shipments, with average iron and manganese contents, of usable[1] manganiferous iron ore (containing 5 to 10 percent Mn, natural) and ferruginous manganese ore (containing 10 to 35 percent Mn, natural) from mines in the Cuyuna Range, in long tons

Year	Manganiferous iron ore			Ferruginous manganese ore			Total shipments
	Shipments	Contents (natural)		Shipments	Contents (natural)		
		Fe, percent	Mn, percent		Fe, percent	Mn, percent	
1950–54 (average)	731,893	38.02	5.89	48,407	33.35	11.48	780,300
1955	669,056	39.63	5.90	102,933	33.47	13.15	771,989
1956	481,946	38.01	6.58	84,053	[2] 31.82	11.93	565,999
1957	438,820	39.58	6.28	179,301	34.20	12.02	618,121
1958	285,995	41.47	6.22	44,901	34.51	13.14	330,896
1959	273,541	39.35	6.42	109,586	34.34	11.76	383,127

[1] Direct-shipping and beneficiated ore.
[2] Partly estimated.

The Federal Bureau of Mines continued research at Minneapolis to develop methods of using the potential manganese resources of the Cuyuna Range. Beneficiation research was directed toward production of merchantable manganiferous iron-ore concentrate and toward devising methods for producing enriched feeds for the differential sulfatization process. Amenability studies of a wide variety of unoxidized carbonate slates by the standard-sulfatizing procedure were completed, and a study of the oxidized materials was begun. A report covering diamond drilling, and a magnetic survey conducted by the Bureau on the Cuyuna Range, was published in 1959.[2]

Nickel and Copper.—Rules and regulations governing leases for exploration and mining of copper-nickel deposits on State-owned lands were being considered by the State Executive Council. Release of the "Copper-Nickel Mining Unit Book", prepared by the Minnesota Division of Lands and Minerals and containing descriptions of lands involved, was withheld pending final approval of the regulations by the council. Copper-nickel mineralization is found in certain sections of the Duluth Gabbro in the northeastern part of the State. Geology of the area has been described.[3] Exploratory work indicated that the deposits were no better than marginal.

NONMETALS

Abrasives.—The Jasper Stone Co. produced grinding pebbles and tubemill liners from a quartzite deposit near Jasper, in Rock County. Output of both products decreased from 1958. Unit value for tubemill liners decreased; that of grinding pebbles increased slightly. Some broken material was sold for use as riprap.

Cement.—Portland and masonry cements were produced at Duluth by the Universal Atlas Cement Division of the United States Steel

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[2] Heising, Leonard F., Marovelli, Robert L., Wasson, Paul A., Cooke, S. R. B., and Pennington, James W., Core-Drill Sampling of Cuyuna-Range Manganiferous Iron Formations, Crow Wing County, Minn.: Bureau of Mines Rept. of Investigations 5450, 1959, 34 pp.

[3] Schwartz, G. M., and Davidson, D. M., Geologic Setting of the Copper-Nickel Prospect in the Duluth Gabbro near Ely, Minn.: Trans. AIME, Mining Eng., July 1952, pp. 699–702.

Corp., operating the only cement plant in the State. Total shipments decreased from 1958, chiefly because of a labor strike from October 1 until early November.

Portland-cement output consisted of types I and II (general use and moderate heat) and portland-slag cement. Raw materials used were limestone, slag, gypsum, iron dust, and small quantities of air-entraining compounds.

Clays.—Total production of fire and miscellaneous clay increased 65 percent in quantity and 77 percent in total value from that of 1958 and established a new high. Clay requirements of a new lightweight-aggregate plant, operated by North Central Lightweight Aggregate Co., Inc., near Minneapolis contributed to the record output. Raw material for the plant was obtained from a 300-acre deposit surrounding the plant. Aggregate was produced in a 6-foot-wide, 85-foot-long traveling-grate sintering machine, using North Dakota lignite and petroleum coke as fuel.

Six companies reported production from operations in Brown, Carlton, Goodhue, Hennepin, Ramsey, and Redwood Counties. Material was used principally for manufacturing building brick, lightweight aggregate, vitrified sewer pipe, art pottery, and floor tile.

During 1959 the Federal Bureau of Mines conducted preliminary investigations of clays and shales in the State primarily to determine suitability for lightweight aggregates.

Dinnerware and art pottery were produced by Red Wing Potteries, Inc., at Red Wing from raw materials produced in other States.

Gem Stones.—A small quantity of semiprecious gem stones was collected by hobbyists, chiefly along the north shore of Lake Superior and in the southeastern part of the State. Material reported collected in 1959 was principally agate and jasper. Gem materials collected in the State were used primarily for personal collections and handmade jewelry.

Lime.—Cutler-Magner Co. produced quick and hydrated lime at Duluth. The company was the sole producer of lime in the State. Total quantity and value of sales increased over 1958. Shipments were chiefly to consumers in Minnesota, and neighboring States. Nearly 93 percent of the output was for chemical and industrial use, including paper manufacture, water purification, and metallurgy. The remainder was sold for use in building and agriculture.

Perlite.—Crude perlite mined in New Mexico and Nevada was expanded at plants of Minnesota Perlite Corp. and Western Mineral Products Co. in Minneapolis. The expanded product was sold for lightweight aggregate in plaster and concrete, soil conditioning, and paint additive. Total sales increased over 1958.

Sand and Gravel.—Production of sand and gravel was reported from all but three counties in the State. Total output decreased 4 percent in quantity and value from 1958. Chief reason for the decrease was lesser demand for base course material for highway construction projects, which offset a substantial increase in output for building purposes. Major producing counties were Hennepin, Le Sueur, St. Louis, Stearns, and Washington.

Approximately 70 percent of the quantity produced was for paving and 25 percent for building; substantial quantities were used for railroad ballast. Special types of sands were used for molding, engine use, filler, oilfield fracturing, and glass manufacture. Commercial operators provided 57 percent of the total output; Government-and-contractor operations furnished the remainder. Over 91 percent of shipments to consumers were by truck, 5 percent by rail, and the remainder by river barge.

Stone.—Total production of stone in Minnesota increased 3 percent in quantity and established a new record high, surpassing the previous high set in 1958. Total value of output, however, decreased slightly. Chief reason for the gain in tons, over 1958 was a substantial increase in use of crushed granite for railroad ballast. A marked decrease in production of dimension granite for architectural purposes was primarily responsible for the drop in total value. Stone products included basalt, granite, limestone, marl, and quartzite.

TABLE 8.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1958		1959	
	Short tons (thousands)	Value (thousands)	Short tons (thousands)	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Building	3, 151	$2, 748	4, 028	$3, 275
Paving	1, 781	1, 379	1, 514	1, 127
Fill	193	128	339	166
Undistributed [1]	190	519	237	798
Total	5, 316	4, 774	6, 118	5, 366
Gravel:				
Building	2, 567	3, 685	2, 916	3, 778
Paving	7, 744	6, 190	6, 572	5, 358
Railroad ballast	379	280	447	330
Fill	383	188	278	125
Other	3	1	36	55
Total	11, 077	10, 344	10, 249	9, 646
Total sand and gravel	16, 392	15, 118	16, 367	15, 012
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	22	8	----------	----------
Paving	520	206	3, 292	1, 637
Fill	----------	----------	43	11
Other	----------	----------	10	3
Total	542	214	3, 345	1, 651
Gravel:				
Building	111	47	44	19
Paving	12, 589	6, 300	8, 695	4, 035
Fill	----------	----------	35	9
Total	12, 700	6, 348	8, 774	4, 063
Total sand and gravel	13, 242	6, 562	12, 119	5, 714
ALL OPERATIONS				
Sand	5, 858	4, 988	9, 463	7, 017
Gravel	23, 776	16, 692	19, 023	13, 709
Grand total	29, 634	21, 680	28, 486	20, 726

[1] Includes blast sand (1958) and glass, molding, railroad ballast, engine, filler and other sand (1958–59) to avoid disclosing individual company confidential data.

Limestone was produced in 15 counties, chiefly from deposits along the Minnesota and Mississippi Rivers in the south-central and southeastern part of the State. Output of crushed and dimension limestone decreased 4 percent, and value increased slightly, compared with 1958. Crushed limestone for concrete aggregate and roadstone decreased 5 percent in quantity and 6 percent in value. Sales of agricultural limestone decreased 4 percent in quantity and 11 percent in value. The lower demand was attributed chiefly to extremely wet weather. Use of dimension limestone for architecture increased substantially.

Granite was quarried in three widely separated regions—central Minnesota in Kanabec, Mille Lacs, and Stearns Counties; upper Minnesota River Valley in Big Stone, Lac qui Parle, Redwood, Renville, and Yellow Medicine Counties; and northeast Minnesota in St. Louis County. Finishing plants were operated in St. Cloud, Cold Spring, and Delano. Output of dimension granite, used chiefly for building and monumental purposes, decreased markedly. Crushed or broken granite production increased 52 percent in quantity over 1958, chiefly because of greater use for railroad ballast.

Quartzite was produced in Nicollet and Rock Counties. Total output increased substantially over 1958 because of increased sales for concrete aggregate, seal coating, and filters. Some material was sold for refractories and riprap.

Zenith Dredge Co. produced crushed and broken basalt in St. Louis County for concrete aggregate and roadstone, railroad ballast, and riprap. Output increased over 1958.

Calcareous marl for agricultural use was produced by two companies in Crow Wing and Wadena Counties. Output increased markedly over 1958.

TABLE 9.—Granite sold or used by producers, by uses [1]

Use	1958		1959	
	Quantity (thousands)	Value (thousands)	Quantity (thousands)	Value (thousands)
Dimension:				
Rough construction ... short tons	(2)	$13	(2)	$29
Rough architectural ... cubic feet	(3)	(3)	-----	-----
Rough monumental ... do	(3)	(3)	26	90
Dressed architectural ... do	(3)	(3)	(3)	(3)
Dressed monumental ... do	121	1,179	(3)	(3)
Undistributed ... do	293	2,281	281	2,975
Total equivalent short tons [4]	34	3,473	26	3,094
Crushed and broken:				
Riprap ... short tons	(2)	(5)	-----	-----
Concrete aggregate and roadstone ... do	(6)	(6)	116	202
Railroad ballast ... do	(6)	(6)	485	621
Other ... do	431	773	54	179
Total ... do	431	773	655	1,002
Grand total ... do	466	4,247	681	4,096

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[1] Includes both commercial and Government-and-contractor production.
[2] Less than 1,000 short tons.
[3] Figure withheld to avoid disclosing individual company confidential data; included in "Undistributed."
[4] Average weight of 166 pounds per cubic foot used to convert cubic feet to short tons.
[5] Less than $1,000.
[6] Figures for concrete aggregate, roadstone, and railroad ballast (1958) are combined with "Other" to avoid disclosing individual company confidential data.

TABLE 10.—Limestone sold or used by producers, by uses [1]

Use	1958		1959	
	Quantity (thousands)	Value (thousands)	Quantity (thousands)	Value (thousands)
Dimension:				
Rough construction and rubble.........short tons..	(2)	(2)	12	$81
Rough architectural.........cubic feet..	(2)	(2)	18	49
Sawed.........do....	13	$52	18	70
Cut.........do....	81	656	90	693
House stone veneer.........do....	179	478	270	678
Flagging.........do....	(2)	(2)	2	2
Total.........equivalent short tons [3]..	42	1,385	44	1,573
Crushed and broken:				
Riprap.........short tons..	24	15	(4)	(4)
Concrete aggregate and roadstone.........do....	2,385	2,754	2,265	2,592
Agriculture.........do....	477	772	458	684
Asphalt.........do....	(4)	(4)	49	250
Other [5].........do....	43	210	36	47
Total.........do....	2,930	3,751	2,808	3,573
Grand total.........do....	2,972	5,135	2,852	5,146

[1] Includes both commercial and Government-and-contractor production.
[2] Figure withheld to avoid disclosing individual company confidential data; included in total.
[3] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.
[4] Included with "Other" to avoid disclosing individual company confidential data.
[5] Includes flux, mineral food, and poultry grit (1958–59); asphalt and railroad ballast (1958); and riprap (1959).

Sulfur.—Elemental sulfur was recovered by the Great Northern Oil Co. as a byproduct at its Pine Bend refinery in Dakota County. Output increased substantially over 1958.

Vermiculite.—Crude vermiculite mined in Montana was exfoliated at plants in Minneapolis and St. Paul. Output was greater than in 1958. Material was sold for lightweight aggregate in plaster and concrete, insulation, and other purposes.

MINERAL FUELS

Peat.—No production of peat in Minnesota was reported by operating companies to the Federal Bureau of Mines. However, indications were that at least several hundred tons were produced. Output was chiefly for horticulture.

REVIEW BY COUNTIES

All counties in the State, except Norman and Waseca Counties, produced minerals. St. Louis County led the State, chiefly because of predominant iron-ore mines, furnishing 70 percent of the total mineral value. Mineral output of nine counties exceeded $1 million. Total values increased for 50 counties but decreased for 36, compared with 1958. Decreases in Crow Wing, Itasca, and St. Louis Counties were attributable to fewer iron-ore shipments. On the other hand, total value for Fillmore County gained because of increased iron-ore shipments. Mines in that county continued to operate during the prolonged steel strike. Most of the gains or decreases in other counties depended on demand for road-construction materials. Sand

and gravel production was common to all counties reporting except Dodge County.

Becker.—Sand and gravel production in the county decreased substantially from 1958. Becker County Sand & Gravel Co. and Ernest Anderson operated fixed and portable plants, respectively, near Detroit Lakes. Material was for building and road construction, railroad ballast, and engine use. Sand and gravel also was produced by and for the State and county highway departments.

TABLE 11.—Value of mineral production in Minnesota, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Aitkin	$119,087	$10,870	Sand and gravel.
Anoka	14,537	18,204	Do.
Becker	(2)	(2)	Do.
Beltrami	126,714	171,699	Do.
Benton	(2)	(2)	Do.
Big Stone	(2)	(2)	Stone, sand and gravel.
Blue Earth	1,153,356	1,106,451	Do.
Brown	413,962	425,133	Sand and gravel, clays.
Carlton	199,564	187,994	Do.
Carver	202,574	208,406	Sand and gravel.
Cass	(2)	25,155	Do.
Chippewa	(2)	309,805	Do.
Chisago	(2)	(2)	Do.
Clay	443,787	703,971	Do.
Clearwater	4,150	2,328	Do.
Cook	26,975	83,245	Do.
Cottonwood	189,515	135,927	Do.
Crow Wing	[3] 10,801,794	9,212,198	Iron ore, manganiferous ore, sand and gravel, stone.
Dakota	779,143	798,568	Sand and gravel, stone.
Dodge	175,027	153,750	Stone.
Douglas	104,518	72,577	Sand and gravel.
Faribault	106,307	427,062	Do.
Fillmore	2,101,860	(2)	Iron ore, stone, sand and gravel.
Freeborn	(2)	(2)	Sand and gravel.
Goodhue	412,362	485,015	Stone, sand and gravel, clays.
Grant	63,948	113,872	Sand and gravel.
Hennepin	3,315,024	3,067,176	Sand and gravel, clays.
Houston	(2)	103,724	Stone, sand and gravel.
Hubbard	57,972	5,036	Sand and gravel.
Isanti	42,023	(2)	Do.
Itasca	83,543,278	60,703,342	Iron ore, sand and gravel
Jackson	141,180	194,123	Sand and gravel.
Kanabec	(2)	(2)	Stone, sand and gravel.
Kandiyohi	368,832	475,552	Sand and gravel.
Kittson	(2)	(2)	Do.
Koochiching	(2)	49,744	Do.
Lac qui Parle	318,152	514,429	Stone, sand and grave
Lake	34,319	41,514	Sand and gravel.
Lake of the Woods	14,181	82,782	Do.
Le Sueur	1,208,038	1,663,251	Sand and gravel, stone.
Lincoln	71,869	(2)	Sand and gravel.
Lyon	201,615	113,042	Do.
Mahnomen	258,528	(2)	Do.
Marshall	207,410	130,163	Do.
Martin	325,439	243,888	Do.
McLeod	115,066	133,852	Do.
Meeker	288,614	141,204	Do.
Mille Lacs	(2)	(2)	Stone, sand and gravel.
Morrison	270,458	72,750	Sand and gravel.
Mower	492,055	364,497	Stone, sand and gravel.
Murray	1,906	558	Sand and gravel.
Nicollet	336,357	309,681	Stone, sand and gravel.
Nobles	104,231	110,552	Sand and gravel.
Norman	72,238	--------------	
Olmsted	279,440	326,654	Sand and gravel, stone.
Otter Tail	128,875	261,571	Sand and gravel.
Pennington	27,034	19,839	Do.
Pine	12,767	37,510	Do.
Pipestone	(2)	(2)	Do.
Polk	523,652	527,597	Do.
Pope	62,728	112,600	Do.
Ramsey	401,566	457,009	Sand and gravel, clays.
Red Lake	2,769	3,680	Sand and gravel.
Redwood	90,356	84,563	Sand and gravel, stone, clays.
Renville	1,055,215	713,830	Stone, sand and gravel.

See footnotes at end of table.

TABLE 11.—Value of mineral production in Minnesota, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Rice	282,909	298,910	Sand and gravel, stone.
Rock	212,413	382,436	Sand and gravel, abrasives, stone.
Roseau	(2)	129,337	Sand and gravel.
St. Louis	269,627,025	244,102,919	Iron ore, cement, sand and gravel, lime, stone.
Scott	641,451	951,691	Stone, sand and gravel.
Sherburne	48,138	(2)	Sand and gravel.
Sibley	(2)	117,621	Do.
Stearns	3,417,959	3,191,620	Stone, sand and gravel.
Steele	375,201	391,713	Sand and gravel, stone.
Stevens	(2)	(2)	Sand and gravel.
Swift	157,847	237,363	Do.
Todd	375,960	147,566	Do.
Traverse	1,017	15,226	Do.
Wabasha	37,020	115,340	Sand and gravel, stone.
Wadena	(2)	(2)	Do.
Washington	1,831,461	1,195,717	Do.
Watonwan	113,296	84,767	Sand and gravel.
Wilkin	68,708	108,668	Do.
Winona	660,957	685,478	Stone, sand and gravel.
Wright	231,081	232,760	Sand and gravel.
Yellow Medicine	405,382	498,442	Stone, sand and gravel.
Undistributed	5,479,524	8,572,594	
Total	395,880,000	347,178,000	

[1] No production reported for Waseca County.

[2] Figure withheld to avoid disclosing individual company confidential data; value included with "Undistributed."

[3] Revised figure.

Beltrami.—Ritchie & Tell operated a fixed sand and gravel plant near Wilton and a portable plant elsewhere. Output was principally for road use. The county highway department produced and contracted for paving gravel. Sand and gravel for roads was produced under contract for the Minnesota Highway Department.

No clay was produced by the Bemidji Brick Co. in 1959. Brick manufactured previously was sold from inventory. At the close of the year the company was being liquidated.

Big Stone.—Total value of granite and sand and gravel decreased 32 percent from 1958. Cold Spring Granite Co. and Delano Granite Works, Inc., quarried granite near Ortonville and Odessa, respectively. The rough material was processed at company finishing plants in Cold Spring and Delano. Output was for architectural and monumental purposes. Rausch Bros. Granite Co. operated a custom-sawing plant at Ortonville. Material processed at this plant was produced chiefly in Grant County, S. Dak.

Hallett Construction Co. operated a portable plant near Odessa and produced sand and gravel for building and road construction. The State highway department contracted for paving sand and gravel.

Blue Earth.—Dimension limestone was produced at Mankato by Mankato Stone Co. and Vetter Stone Co. Output was primarily for architectural use. Some material was sold as rubble and flagging. Crushed and broken limestone for road surfacing, agricultural use, and riprap was produced by Lundin Construction Co. near Mankato. Production was slightly more than in 1958.

Producers of sand and gravel included Guaranteed Gravel & Sand Co., Hallett Construction Co., Hiniker Sand & Gravel Co., and North Star Concrete Co. All operations were in the Mankato area. Output was for building and road purposes. The State highway department contracted for paving sand and gravel. Portable equipment of Jeffries Construction Co. was moved to another State.

Brown.—Ochs Brick & Tile Co. produced miscellaneous clay near Springfield. Output was used by the company chiefly for manufacturing building brick.

Sand and gravel was produced for building and road construction. Carlson Bros., Inc., and Roberts Bros. operated portable plants near Comfrey and Sleepy Eye, respectively. Fixed plants were operated by Math N. Schumacher near Springfield, Wallner Construction Co. near New Ulm, and M. M. Youngman near Sleepy Eye. The State and county highway departments contracted for road gravel.

Carlton.—Sand and gravel was produced by several companies operating portable and stationary plants near Carlton, Cloquet, and Moose Lake. Output was for building and road purposes, railroad ballast, and fill. The city of Cloquet and the county highway department produced and contracted for gravel for building, paving, and fill. Sand and gravel for road construction was produced under contract for the Minnesota Highway Department.

Fire clay was produced near Moose Lake by the Nemadji Tile & Pottery Co. for use in manufacturing art pottery and floor tile.

Red Wing Peat Corp. began producing peat on State-owned land near Corona. The company completed construction of its processing plant early in 1959.

Cook.—Erie Mining Co. shipped about 4 million long tons of taconite-concentrate pellets from Taconite Harbor. First cargo of the season was loaded April 20. Shipments were interrupted in midseason by the 116-day strike of the United Steelworkers of America. Shipments resumed after strikers returned to work early in November and continued to December 14.

Sand and gravel for building was produced by Edwin E. Thoreson, operating a fixed plant near Grand Marais. The county highway department contracted for paving gravel.

Crow Wing.—Total value of minerals produced in the county decreased 15 percent from 1958, chiefly because of the decline in iron-ore shipments brought about by the prolonged steel strike. Operating companies and mines from which iron and/or manganiferous ores were shipped in 1959 included:

Company:	*Mines*
The M. A. Hanna Co	Alstead group, Feigh, Huntington, Maroco, Musser, Portsmouth, Robert, and South Hillcrest.
Inland Steel Co	Armour No. 1 and Armour No. 2.
Pickands Mather & Co	Mahnomen, Sagamore, and Rabbit Lake.
Pittsburgh Pacific Co., Zontelli Brothers Division	Mangan Lot No. 5, Mangan-Joan, Mangan-Stai, Manuel, Merritt Stockpile, and West Airport.
Rhude & Fryberger	Brown Underground and Carlson-Nelson.

All mines except the Armour Nos. 1 and 2, and Brown Underground mines were open pits. Approximately 67 percent of the iron ore shipped from the county was direct-shipping grade; the remainder was concentrate. Inland Steel Co. hoisted the first ore from the new Armour No. 2 production shaft in June. The company planned to abandon the Armour No. 1 shaft. Shipments were begun from the Robert mine of The M. A. Hanna Co. Over 3 million cubic yards of overburden had been removed from this property since stripping was begun in 1957. Construction at the mine included a new crushing plant and a large shop building. Other activity of The M. A. Hanna Co. in the county included overburden stripping for a westerly extension of the Huntington mine and construction of a fines loading pocket at the Maroco plant. Shipments were resumed from the Rabbit Lake and Carlson-Nelson mines, operated by Pickands Mather & Co. and Rhude & Fryberger, respectively. Both mines were inactive in 1958.

All manganiferous ore produced in Minnesota in 1959 was from mines in Crow Wing County. Shipments increased 16 percent over 1958.

Manganese carbonate, manganese dioxide, and other manganese products were produced from Cuyuna Range manganiferous ore by Manganese Chemicals Corp. at Riverton.

Sand and gravel for roads was produced by Adair Sand & Gravel Co. and Hallett Construction Co., operating portable plants near Brainerd and Fort Ripley, respectively. The county highway department produced and contracted for sand and gravel for paving use, fill, and other purposes. The Minnesota Highway Department contracted for paving sand and gravel.

Tweed Bros. produced marl for agricultural use from a shallow pit near Long Lake.

Dakota.—J. L. Shiely Co. ceased operating its Mendota quarry. However, the company sold a quantity of dimension limestone for use as rubble. Northwestern Gravel Co., Inc., produced crushed limestone for roads at a quarry near Savage. The company also produced sand and gravel for building and road construction and fill. Bituminous Surface Treating Co. produced gravel near Inver Grove chiefly for asphalt mix. Standard Building Material Co. produced sand and gravel near South St. Paul for building. Edward M. Husting produced building sand near Hastings. The county highway department produced and contracted for sand and gravel for roads and other purposes. The Minnesota Highway Department contracted for paving sand and gravel.

The Great Northern Oil Co. recovered byproduct elemental sulfur from crude oil imported from Saskatchewan at its refinery at Pine Bend.

Fillmore.—Shipments of iron ore from mines in Fillmore County were more than 575,000 long tons, the highest on record for the county. The previous high was in 1952. The M. A. Hanna Co. shipped 491,000 tons of iron-ore concentrate from its Spring Valley group of mines. Schroeder Mining Co. shipped 85,000 tons of concentrate from the Krueger mine near Chatfield. Operations were not involved in the long labor strike affecting most of the mines in the State. Both companies operated through the season, shipping ores entirely by rail to Granite City, Ill.

Crushed limestone for agriculture and roads was produced by Hadland & Vreeman and Kappers Construction Co., operating portable crushing plants near Ostrander and Fountain, and by Pederson Bros., operating a stationary plant near Harmony.

Sand and gravel for building, roads, and other purposes was produced near Chatfield and Peterson. The State highway department contracted for sand and gravel for road use.

Goodhue.—The Red Wing Sewer Pipe Corp. produced fire clay from pits near Goodhue. The company used the material in manufacturing vitrified sewer pipe, draintile, flue liners, and filter block. Red Wing Potteries, Inc., manufactured dinnerware and art pottery at Red Wing. Raw materials used were produced in other States.

Valley Limestone Co. produced crushed limestone for agricultural and road purposes at a quarry near Zumbrota. Mann Construction Co. operated a portable crushing plant at various locations in the county and produced limestone for agricultural use, roadstone, and rubble. The company also produced sand and gravel for road construction. Several other companies, operating fixed and portable plants near Frontenac, Lake City, and Red Wing, produced sand and gravel for building, roads, and fill. The State and county highway departments contracted for paving sand and gravel.

Hennepin.—Nearly 3 million tons of sand and gravel was produced in the county in 1959, chiefly in the suburban areas of Minneapolis. Output was for building, roads, and other purposes. Commercial operators included: Alexco Aggregates, Inc.; Anderson Aggregates, Inc.; Barton Contracting Co.; Concrete Service, Inc.; Consolidated Materials Co.; Chas. M. Freidheim Co.; Glacier Sand & Gravel Co.; J. V. Gleason; Hedberg & Sons Co.; Hopkins Sand & Gravel Co.; Industrial Aggregate Co.; Keller Bros. Gravel Co.; Landers-Norblom-Christenson Co.; Mapco Sand & Gravel Co.; and Oscar Roberts Co. The State highway department contracted for sand and gravel for road use.

North Central Lightweight Aggregate Co., Inc., operated a new plant near Minneapolis and produced lightweight aggregate from clay mined near the plant. An article describing the operation was published.[4]

Minnesota Perlite Co. and Western Mineral Products Co. expanded perlite at plants in Minneapolis. Raw material for the plants was produced in New Mexico and Nevada. Output was sold for lightweight aggregate in plaster and concrete, soil conditioner, and paint. Exfoliated vermiculite was produced in Minneapolis by B. F. Nelson Mfg. Co. and Western Mineral Products Co. Crude material processed was mined in Montana. The exfoliated product was used for lightweight aggregate in plaster and concrete, insulation, and other purposes.

Late in the year Lithium Corp. of America closed its plant in St. Louis Park, where the company manufactured lithium salts and metal. The company planned to move its manufacturing facilities and research and development laboratories to Bessemer City, N.C.

A new Federal Bureau of Mines research center at Fort Snelling was completed in November. The center was to be headquarters for Bureau mining, metallurgical, and other related research activities, primarily in the North Central States. The main building consists of a four-story laboratory, a two-story administrative wing, and a pilot-plant wing. Also included is a three-story ore-crushing plant and a maintenance building. The main building and the crushing plant have a total of approximately 87,000 square feet.

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[4] Rock Products, Lignite Fuels New Traveling rate Installation: Vol. 62, No. 3, March 1955, pp. 88–91.

Itasca.—Shipments of usable iron ore from mines in Itasca County decreased 28 percent from 1958, because of the 116-day strike. Virtually all mines and beneficiating plants in the county were shut down during the strike period. Approximately 93 percent of the total shipments consisted of beneficiated ore; the remainder was direct-shipping grade. Operating companies and mines from which iron ore was shipped in 1959 were:

Company:	*Mines*
Cleveland-Cliffs Iron Co	Canisteo, Hawkins, Hill-Trumbull, Holman-Cliffs, and Sally.
The M. A. Hanna Co	Argonne group, Harrison group, Hunner, Mississippi group, and Patrick group.
Jessie H. Mining Co	Jessie.
Jones & Laughlin Steel Corp	Hill Annex.
Oliver Iron Mining Division, United States Steel Corp	Arcturus group, King group, and Plummer.
Pacific Isle Mining Co	St. Paul.
Pickands Mather & Co	Bennett, Danube, Tioga No. 2, and West Hill.

All mines operating in the county were open pits.

Shipments were resumed from the Bennett mine of Pickands Mather & Co. Ore from the Bennett was concentrated by washing and heavy-medium separation. Shipments from the company West Hill mine were from stock.

The Lind-Greenway mine of Jones & Laughlin Steel Corp. was being developed during the year. The mine is on the extreme western end of the Mesabi Range near Grand Rapids. Construction of a new concentrator for the mine was nearly complete at yearend.

Pacific Isle Mining Co. shipped ore from a stockpile at the St. Paul mine.

Jessie H. Mining Co. acquired an electric suction dredge for stripping overburden at a newly acquired property near the company Jessie mine. The dredge had a 16-inch suction and a 14-inch discharge. Rated capacity was 350 cubic yards per hour.

No shipments were recorded for the Carlz No. 2 and Patrick "C" of The M. A. Hanna Co.

Road gravel was produced by several companies, operating portable and fixed plants near Cohasset and Grand Rapids. The State and county highway departments contracted for paving gravel.

Kanabec.—Cold Spring Granite Co. produced granite for architectural and monumental purposes from its Mora Grey quarry. The company processed rough stone at its finishing plant in Cold Spring. Road gravel was produced under contract for the State highway department.

Lac qui Parle.—Cold Spring Granite Co. quarried granite near Odessa and shipped the rough material to its plant in Cold Spring for processing. Output was for architectural use and monuments. The North Star Granite Corp. produced granite for monuments from its No. 9 quarry near Odessa. The rough stone was processed at the company plant in St. Cloud. Granite for monuments also was produced by the Dakota Granite Co. and Dewar Bellingham Granite Co. near Bellingham and by Liberty Granite Co., Inc. near Louisburg. The latter company discontinued business in September.

W. J. Stolpman operated a portable sand and gravel plant near Rosen and produced paving gravel. The State and county highway departments contracted for sand and gravel for road use.

Lake.—Reserve Mining Co. processed approximately 10 million long tons of crude taconite at its Silver Bay plant. The crude material was mined near Babbitt, St. Louis County. About 4 million long tons of taconite-concentrate pellets was shipped from Silver Bay. Operations were at a standstill during the prolonged steel strike. The first cargo of pellets shipped from Silver Bay in 1959 was loaded April 20. The final cargo of the season left the port December 14.

Haack Bros. produced sand and gravel for building and road construction near Two Harbors. The State highway department contracted for paving sand and gravel.

Le Sueur.—The Babcock Co. produced dimension limestone near Kasota. Principal products were stone veneer and cut stone. Part of the output was marketed as "marble" for interior trim and facings. Some material was sold for rough construction and riprap. Ed. Swartout operated a portable crushing plant near Kasota and produced crushed limestone for road use.

Gopher State Silica, Inc., produced silica sand from the Jordan Sandstone formation near Le Sueur. Output was sold for glass manufacturing, molding, oilfield fracturing, filler, and building. Sand and gravel for building and roads was produced by several companies near Gaylord, Kasota, and Waterville. The State highway department contracted for sand and gravel for roads.

Mille Lacs.—Dimension granite for architectural use and monuments was produced by Cold Spring Granite Co. from its Diamond Grey quarry near Isle. The company processed the rough stone at its Cold Spring plant.

The Mille Lacs Sand & Gravel Co. operated a fixed plant near Milaca and produced sand and gravel for building and roads. Paving sand and gravel was produced under contract for the State highway department.

Mower.—Martin Bustad & Son produced crushed limestone for agriculture and roads near Austin. Osmundson Bros. operated a portable crushing plant near Adams and produced limestone for agriculture, roadstone, and rubble. Hickok Calcium White Rock Co. produced limestone near LeRoy for use as flux, mineral food, poultry grit, and rubble. The county highway department contracted for crushed limestone and gravel for roads.

Several companies operated fixed and portable plants near Austin, producing sand and gravel for building, roads, and other uses. The State highway department contracted for paving sand and gravel.

Nicollet.—New Ulm Quartzite Quarries, Inc., produced crushed quartzite at a quarry near New Ulm. Output was sold chiefly for concrete aggregate and roadstone, filter blocks for water and sewage treatment plants, and refractories.

Sand and gravel for building, roads, and other uses was produced by several companies operating plants near Courtland and St. Peter. The county highway department contracted for paving gravel.

Olmsted.—Crushed limestone for agriculture and roads was produced in the county.

Riverside Sand & Gravel Co. and Rochester Sand & Gravel Co. operated fixed plants at Rochester and produced sand and gravel for building, roads, and other uses. Paving sand and gravel was produced under contract for the State and county highway departments.

Otter Tail.—Mark Sand & Gravel Co. operated a fixed sand and gravel plant about 15 miles east of Fergus Falls and a portable plant near various road projects. Output was used mostly as base course material and aggregate for bituminous roads. The company also furnished material to a concrete block factory, ready-mix plant, and a concrete tile factory in Fergus Falls. John Dieseth Co. operated a portable plant near Fergus Falls and produced gravel for road use and fill. The Minneapolis, St. Paul & Sault Ste. Marie Railroad Co. operated a portable plant near Vergas and produced gravel for railroad ballast and fill. The State highway department contracted for paving sand and gravel.

Construction began on new Interstate Highway No. 94, which was expected to increase demand for road material substantially.

Polk.—Spring Gravel Co. operated a fixed sand and gravel plant about 15 miles southeast of Crookston. Material was sold chiefly to ready-mix plants, a concrete block factory, and to road contractors. Much of the output was shipped to a concrete block plant and ready-mix plants at or near Grand Forks, N. Dak. Thorson Gravel Co. produced gravel near Fertile for building, roads, and railroad ballast. The Great Northern Railway Co. operated a portable plant near Benoit and produced gravel for building, railroad ballast, and fill.

Ramsey.—The Ford Motor Co. mined silica sand from the St. Peter sandstone formation underlying its property in St. Paul. The entire output was used by the company for manufacturing glass. Arsenal Sand & Gravel Co. operated a fixed plant near New Brighton and produced sand and gravel for building, roads, and other uses. Sand and gravel for roads was produced under contract for the U.S. Army Corps of Engineers and the State highway department.

Miscellaneous clay was produced by the Twin City Brick Co. and used by the company chiefly for manufacturing building brick.

The MacArthur Co. exfoliated vermiculite at its plant in St. Paul. Output was sold for use as lightweight aggregate in plaster and concrete and for insulation.

Redwood.—The View Quarry Co. produced dimension granite near Belview for monuments.

Miscellaneous clay was produced by Ochs Brick & Tile Co. near Morton. The company hauled the material by truck to the company brick plant in Springfield for processing. Donovan, Inc., investigated a fire-clay occurrence near Redwood Falls. A sample was obtained for testing.

Chapman Gravel Co. and Buterbaugh Sand Co. operated fixed plants near Belview and Walnut Grove, respectively, and produced sand and gravel for building and other uses. The State highway department contracted for paving sand and gravel.

Renville.—Cold Spring Granite Co. produced granite from two quarries near Morton. One of these was the Melrose Tapestry quarry, formerly operated by the Melrose Granite Co. The latter company sold its operations to Cold Spring Granite Co. in December 1958. The rough stone was processed at plants in Cold Spring and St. Cloud. Output was for architectural use and monuments.

Sand and gravel for building, roads, and other uses was produced by six companies operating fixed and portable plants near Belview, Danube, Hector, Olivia, and Sacred Heart. The State highway department contracted for paving sand and gravel.

Rice.—Bryan Rock Products, Inc., operated a portable plant near Northfield and produced crushed limestone for agriculture and roads. Faribault Quarries produced dimension and crushed limestone near Faribaults for architectural use, rubble, and roadstone.

Several companies produced sand and gravel for building, roads, and other uses. The State and county highway departments contracted for paving sand and gravel.

Rock.—Grinding pebbles and tubemill liners were produced by the Jasper Stone Co. near Jasper. Some broken quartzite was sold as riprap.

Sand and gravel was produced by three companies operating fixed plants near Leota and Luverne. Output was for building, roads, and other uses. Road gravel was produced under contract for the county highway department.

St. Louis.—Total value of mineral output in St. Louis County decreased more than 9 percent. Chief reason for the decrease was the 11 percent drop in iron-ore shipments resulting from the 116-day steel strike. All but a few mines and concentrating plants were shut down during the entire strike. Mines in St. Louis County furnished 76 percent of the total usable iron ore shipped from the State in 1959. Over 55 percent of county shipments was direct-shipping grade; the remainder was beneficiated. Operating companies and mines from which iron ore was shipped in 1959 were:

Company:	*Mines*
Charleston Iron Mining Co	Missabe Mountain and Minnewas LOSP.
Haley-Young Mining Co	Elbern.
The M. A. Hanna Co	Agnew # 2-South Agnew, Douglas, Duncan, East Alpena, Enterprise, Morton-South Eddy, North Uno, South Longyear, and Weggum.
Jones & Laughlin Steel Corp	Columbia-Missabe Mountain, Leetonia, Longyear, and Schley-Pettit.
W. S. Moore Co	Judson, Judson Extension, Mariska, and Norman.
North Range Mining Co	Leonidas.
Oglebay Norton Co	St. James.
Oliver Iron Mining Division, United States Steel Corp	Canton (St. James), Gilbert, Hull-Rust group, Iron Range Reserve (0–87), Kosmerl, Monroe group, Pilotac, Pioneer, Rouchleau group, Sherman group, Soudan, and Stephens.
Oreclone Concentrating Corp	Prindle Trailings.
Pacific Isle Mining Co	Iroquois, Missabe Mountain South Lease, Missabe Mountain LOSP., Wacootah, and Wisstar.

Company:	*Mines*
Picklands Mather & Co	Bennett, Embarrass, Erie Commercial Pit, Erie Preliminary Taconite Plant, Mahoning, and Scranton.
Pioneer Mining Co	Mary Ellen.
Pittsburgh Pacific Co	Chataco, Commodore, Meadow, Meadow Extension, Sidney, and Wyoming.
Republic Steel Corp	Susquehanna.
Reserve Mining Co	Peter Mitchell.
Rhude & Fryberger	Alworth, Boeing, Pearsall, and Troy.
Snyder Mining Co	Godfrey, Webb-Sellers Triangle, and Whiteside.
E. A. Young, Inc	Minnewas.
Zenith Mining Co	Zenith.

All mines operated were in the Mesabi Range except the Pioneer, Soudan, and Zenith underground mines in the Vermilion Range. Other producing underground mines in St. Louis County were the Leonidas and Godfrey. In March, North Range Mining Co. ceased mining operations at the Leonidas mine near Eveleth. The Zenith mine was reopened early in 1959 by the Zenith Mining Co., jointly owned by W. S. Moore Co. and North Range Mining Co. The latter company was the operating agent. Considerable work was involved in reopening the mine, which included replacing timbers, installing steel sets in principal mine areas, and installing a new crusher-loading pocket on the 18th level. Ore previously was not crushed underground. A new washing plant was constructed at the Zenith to process minus–1¼-inch material. Minus–4-inch, plus–1¼-inch ore was shipped direct as lump ore. Work at the mine continued during most of the strike under an agreement with the United Steelworkers of America, which allowed stockpiling of ore.

Shipments of taconite concentrate decreased slightly. Producers were: Erie Mining Co. (operating agent, Pickands Mather & Co.), operating its taconite mine and processing plant near Hoyt Lakes; Reserve Mining Co., with its mine at Babbitt and processing plant at Silver Bay; and the Oliver Iron Mining Division of United States Steel Corp., operating a mine and concentrator at Mountain Iron and an agglomerating plant at Virginia. Erie Mining Co. announced plans for constructing an addition to the pelletizing building of the Hoyt Lakes plant. The addition was to house two experimental pelletizing furnaces.

Oliver Iron Mining Division planned to construct a new concentrating plant adjacent to the Sherman ore-sizing plant near Chisholm. The plant was to have primary crushing, screening, and concentrating facilities, including scrubbers, and heavy-medium and spiral units. Annual capacity of the plant was to be 1.5 million tons of concentrate. Low-grade ores from the Monroe and Sherman groups of mines will be processed at the plant. Installation of pipelines, ditching, and grading were progressing at yearend. Expected completion date was in 1961. In December the company purchased over 2,000 acres of county tax-forfeited land in the Mountain Iron area. It was expected that the company would use the land for taconite development.

Development continued at the Pierce mine of The M. A. Hanna Co. The company removed over 2.5 million cubic yards of overburden from the property and completed construction of a basin for tailings. The dike around the basin required about 1.2 million cubic yards of material. A railroad spur into the property was laid. Plant facilities also were under construction. The plant will include crushing, screening, heavy-medium, cyclone, and spiral units. First shipments from the Pierce were expected to begin in 1960.

Shipments were resumed from Pickands Mather & Co. Bennett mine, in Itasca and St. Louis Counties and the Susquehanna mine of Republic Steel Corp.

Snyder Mining Co. begun using a rubber-tired shuttle car to haul ore at the Godfrey mine. Capacity of the car was 17 tons. The company also used rock bolts at the mine to support heavy-gauge wire mesh, a safety precaution to catch spalling roof material.

Pacific Isle Mining Co. constructed a washing plant at the Meadow mine near Aurora and rebuilt the Julia plant near Virginia.

Blast furnaces and coke ovens were operated at Duluth by the American Steel & Wire Division of United States Steel Corp. and Interlake Iron Corp. Basic open-hearth steel furnaces also were operated by the former company.

Universal Atlas Cement Division of United States Steel Corp. produced portland and masonry cements at Duluth. The company plant was closed from October 1 to November 7 because of a strike.

Quick and hydrated lime were produced at Duluth by Cutler-Magner Co. at the State's only lime plant. Output increased and was sold for industrial and chemical uses, building, and agriculture.

The Mesaba Granite Co. produced dimension granite from a quarry near Mountain Iron for monuments.

Crushed and broken basalt was produced by the Zenith Dredge Co. Output was used for concrete aggregate and roadstone, railroad ballast, and riprap.

Approximately 1.3 million tons of sand and gravel was produced in St. Louis County. Eleven commercial companies reported output from various locations in the county. Output was for building, roads, railroad ballast, engine use, fill, and other purposes. Sand and gravel for roads was produced under contract for the State and county highway departments and the city of Duluth.

Scott.—Landers-Norblom-Christenson Co. opened a new quarry near Savage and produced crushed limestone for roadstone and asphalt filler. Crushed and broken limestone was produced by Bryan Rock Products, Inc., near Savage for roadstone, agriculture, and riprap. B & R Rock Products Co. also operated a quarry near Savage and produced crushed limestone for roads.

Sand and gravel for building and roads was produced by four companies operating plants near Belle Plaine, Chaska, Prior Lake, and Shakopee. The county highway department produced paving gravel. The State highway department contracted for paving sand and gravel.

Stearns.—Cold Spring Granite Co. produced granite for architectural use and monuments from various quarries near Cold Spring, Rockville, St. Cloud, and St. Joseph, including quarries formerly operated by Melrose Granite Co. Properties of the latter company were purchased by Cold Spring Granite Co. in December 1958. The rough stone was processed at the company finishing plants in Cold Spring and St. Cloud. A quantity of granite was crushed at the Cold Spring plant and sold for poultry grit. North Star Granite Corp. produced dimension granite from quarries 4 and 5 near St. Cloud and processed the rough stone at its St. Cloud plant. Output was sold chiefly for monuments. Royal Granite Co. operated a finishing plant in St. Cloud. Shiely-Petters Crushed Stone Co. produced crushed granite at a quarry near Waite Park. Output was used for railroad ballast, seal-coating bituminous roads, and other purposes. The Minnesota State Reformatory quarried granite at St. Cloud for rough construction.

Sand and gravel for building and roads was produced by Megarry Bros. and A. C. Petters Co., Inc. The State highway department contracted for paving sand and gravel.

Steele.—Klemmer Construction Co. produced crushed limestone near Owatonna for agriculture and roadstone.

Sand and gravel for building, roads, and other uses was produced by four companies near Austin, Medford, and Owatonna. The county highway department contracted for paving gravel.

Wabasha.—Crushed limestone for agriculture and roads was produced by Patterson Quarries at a portable plant near Plainview.

Sand and gravel was produced near Wabasha by several companies. Output was for roads, railroad ballast, and fill. Paving sand and gravel was produced under contract for the State highway department.

Washington.—J. L. Shiely Co. produced sand and gravel at Grey Cloud Island near St. Paul. Output was chiefly for building. Gemstone Products Co. operated a fixed plant and produced sand and gravel for building and roads. Moelter Construction Co. operated a portable plant near Stillwater and produced sand and gravel, for building, roads, and fill. Paving gravel was produced by Shalander & Shaleen near Scandia and T. S. Schifsky near St. Paul. Paving sand and gravel was produced under contract for the State and county highway departments.

Winona.—The Biesanz Stone Co. produced dimension limestone near Winona chiefly for architectural use. Some was sold as rubble.

Fred Fakler and Patterson Quarries produced crushed limestone for agricultural use and roadstone.

Sand and gravel for building and roads was produced by the Winona Aggregate Co., formerly the Winona Sand & Gravel Co., operating a dredge near Winona. The State highway department contracted for paving sand and gravel.

Wright.—Delano Granite Works, Inc., operated a sawing and finishing plant at Delano. The company processed rough granite quarried in Big Stone County.

Sand and gravel was produced by four companies near Delano, Hanover, and South Haven. Output was for building and roads. The State and county highway departments contracted for paving sand and gravel.

Yellow Medicine.—The Great Northern Railway Co. produced crushed granite near Granite Falls for railroad ballast, roadstone, and other uses. August A. Evanson produced dimension granite near Echo for monuments.

Sand and gravel for building, roads, and other uses was produced by Deutz & Crow Co., Inc., operating a fixed sand and gravel plant at Canby. Granite Falls Construction Co. operated a fixed plant near Granite Falls and produced paving gravel. Burdett C. Long operated a portable plant near Hazel Run and produced sand and gravel for roads and fill. The county highway department produced and contracted for paving gravel. Paving sand and gravel was produced under contract for the State highway department.

The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Mississippi Geological Survey.

By Harry F. Robertson [1] and Tracy W. Lusk [2]

❖

VALUE of mineral production in Mississippi continued an upward trend for the eighth consecutive year and reached a record $181 million in 1959—a gain of 20 percent over 1958. Mineral fuels (petroleum, natural-gas liquids, and natural gas) were the most important mineral commodities and represented 90 percent of the total value. Substantial gains in petroleum, natural gas, miscellaneous clay, and cement output caused most of the increase.

Many varied industries took advantage of the State's "Balance Agriculture With Industry" (BAWI) program during 1959, and subsequent increased markets for mineral commodities produced in Mississippi resulted.

Port development moved forward during the year as the two largest ports (Gulfport and Pascagoula) planned $10 million expansions to

TABLE 1.—Mineral production in Mississippi [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	576	$3,338	747	$4,064
Natural gas ... million cubic feet	160,143	22,260	[2] 178,000	[2] 24,900
Natural-gas liquids: Natural gasoline and cycle products ... thousand gallons	25,738	1,658	23,207	1,495
LP-gases ... do	9,208	503	8,141	465
Petroleum (crude) ... thousand 42-gallon barrels	39,512	113,004	[2] 47,928	[2] 136,116
Sand and gravel	6,545	6,240	7,520	7,743
Stone [3]	102	92	126	114
Value of items that cannot be disclosed: Certain metals and nonmetals		4,820		6,751
Total Mississippi [4]		[5] 151,412		181,086

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Excludes certain stone, value included with "Value of items that cannot be disclosed."
[4] Total has been adjusted to eliminate duplication in value of clays and stone.
[5] Revised figure.

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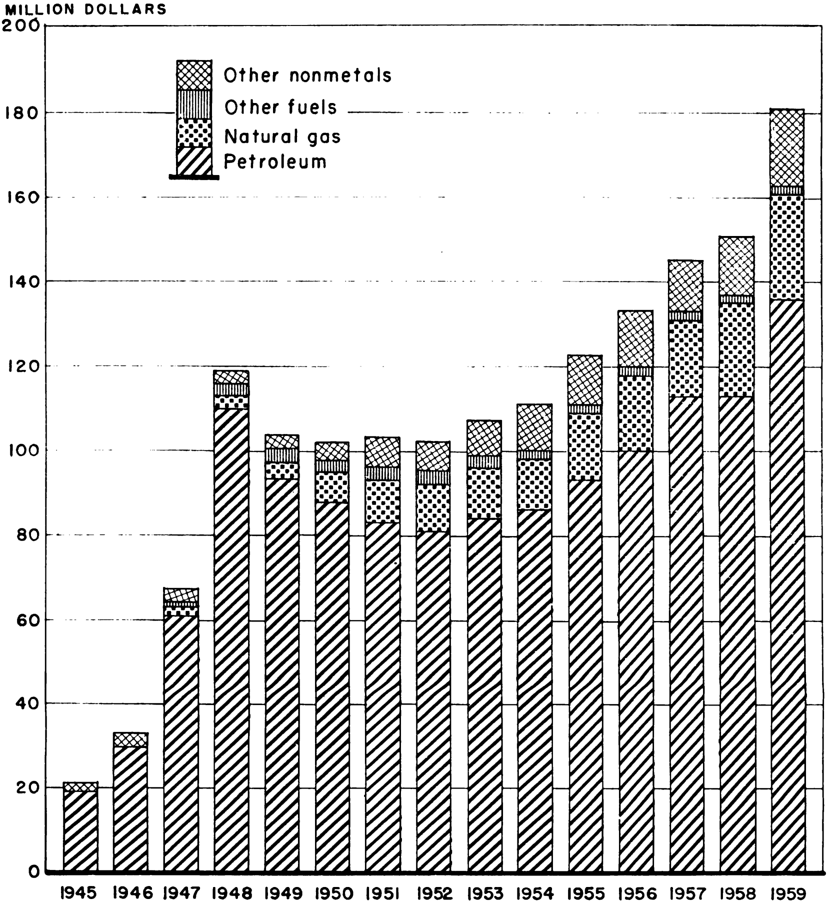

FIGURE 1.—Value of petroleum, natural gas, and total value of mineral production in Mississippi, 1945–59.

be financed by bond issues authorized by a new program administered by the Agricultural and Industrial Board.

Significant river-port developments were a $5 million project under construction at Vicksburg, new facilities at Greenville, and an industrial park at Natchez. New markets for the State mineral products resulted from expansion of exporting facilities.

Highway construction throughout the State showed substantial gains as primary, secondary, and interstate road projects were completed or advanced.

A comprehensive report on the mineral resources of Mississippi, released in June 1959, summarized the State contribution to the National mineral economy. The report reviewed trends in producing various mineral items, discussed geographic and geologic distribution of various raw-mineral materials, and suggested opportunities for further development of these resources. A transportation map showing highways, railways, airlines, and navigable waters and a map showing oil and gas fields and pipelines were included in addition to numerous illustrations and selected topical references.[3]

Employment and Injuries.—As a result of the increased industrial activity in the State, average employment for the year showed a corresponding increase, according to the Mississippi Employment Security Commission. Employment in the petroleum and natural gas industries averaged 5,308 workers, and in the nonmetallic mining and processing industries, averaged 883 workers.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Ranked as the ninth leading oil producing State, Mississippi had produced a cumulative total of nearly 650 million barrels of oil and established large reserves. The preliminary 1959 total of 48 million barrels established a new crude oil production record for the first time in 11 years. Daily average production was about 140,000 barrels of oil and 555 million cubic feet of natural gas from an increased number of wells and fields. Production was from 30 of the 82 counties, mostly in the southern half of the State. Minor exploratory work was done in the northern part of the State.

The trend toward deeper drilling continued, resulting in development of deeper reservoirs in a number of the older fields, productive from semishallow depths. More wells were dually completed than in any previous year, and the first triple completion was authorized in the Bryan field in Jones County. These multiple-zone reservoirs were in the central and southeastern sections of Mississippi.

The number of wells drilled totaled 648—225 more than in 1958—not including 45 producers completed as dual wells. Exploratory and field drilling developed new oil and gas reserves.

Thirteen new field discoveries included West Deerfield and Southeast Fairview in Adams County; Kiln in Hancock County; Grange in Jefferson Davis County; Laurel in Jones County; East Dexter in Marion County; South Stewart in Pearl River County; McComb and Summit in Pike County; Morton in Scott County; Merit in Simpson County; West Dexter in Walthall County; and Thompson's Creek in Wayne County.

Extensive drilling in the new McComb field resulted in development of a major oil reservoir. At the end of the year it was the most active area in the State.

According to the Mississippi State Oil and Gas Board, 188 oil pools and 43 gas pools were producing in 161 fields at yearend. Producible wells totaled 2,754, an increase of 172 wells over 1958.

Natural Gas.—Marketed production of natural gas continued an upward trend, increasing about 12 percent from 1958. Two fields discovered during the year, Grange in Jefferson Davis County and South Stewart in Pearl River County, added considerably to known State gas reserves. Counties leading in natural gas production, in order of value, were: Forrest, Jefferson Davis, Pearl River, Monroe, and Lamar.

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[3] Mellen, Frederic F., Mississippi Mineral Resources: Mississippi Geol. Survey Bull. 86, 1959, 100 pp.

TABLE 2.—Total well completions in 1959, by counties [1]

County	Proved field or development wells			Exploratory wells			Total
	Oil	Gas [2]	Dry	Oil	Gas [2]	Dry	
Adams	19		19	2		30	70
Amite						6	6
Chickasaw						1	1
Clarke	14		5			10	29
Copiah						2	2
Covington						1	1
Forrest	2	13	3			6	24
Franklin	8		11			12	31
George						1	1
Greene						4	4
Hancock		2		1		1	4
Hinds	7		1			5	13
Humphreys						1	1
Issaquena	1		2			5	8
Itawamba		1				2	3
Jackson						1	1
Jasper	3		3			5	11
Jefferson	1		2			15	18
Jefferson Davis		2			1	2	5
Jones	30		3	1		8	42
Lamar	11		1			2	14
Lawrence						1	1
Leake						2	2
Lincoln	27		10			13	50
Madison						8	8
Marion	2	5	2	1		3	13
Monroe			1			1	2
Newton						1	1
Oktibbeha						1	1
Pearl River	6	4	6		1	10	27
Perry						4	4
Pike	64		17	2		17	100
Rankin						3	3
Scott	3		3	1		8	15
Sharkey						3	3
Simpson	11	1	3	1		6	22
Smith	19		1			13	33
Stone						3	3
Walthall	3	3	2	1		2	11
Washington						2	2
Wayne	7		7	1		15	30
Wilkinson	2		3			14	19
Yazoo	2		1			6	9
Total: 1959	242	31	106	11	2	256	648
1958	145	35	63	12	1	167	423

[1] Mississippi State Oil and Gas Bulletin, Jackson, Miss., vol. 59, No. 1, March 1959, through No. 12, February 1960.
[2] Includes condensate.

TABLE 3.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1958	Changes in proved reserves due to extensions and new discoveries in 1959	Proved reserves, Dec. 31, 1959 (production deducted)	Change from 1958, percent
Crude oil ... thousand barrels	378,688	57,980	389,337	+3
Natural-gas liquids [2] ... do	55,182	−11,565	40,944	−26
Natural gas ... million cubic feet	2,598,377	51,281	2,486,524	−4

[1] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 14, Dec. 31, 1959, pp. 9, 10, 19.
[2] Includes condensate, natural gasoline, and LP-gases.

During 1959, Southern Natural Gas Co. completed gas-transmission facilities to connect with additional supplies in Mississippi. Most important was 80 miles of 18-inch pipeline between Cranfield and Gwinville. United Gas Pipe Line Co. completed 43 miles of 30-inch pipeline between Mandeville, La., and Kiln, Miss., and 37 miles of 30-inch pipeline from Gulfport to Moss Point. The company also began constructing 40 miles of 30-inch pipeline between Kiln, Miss. and Whistler Junction, Ala.

Of the total gas withdrawn, about 57 billion cubic feet was returned to producing reservoirs of the Cranfield, Brookhaven, and Hub fields.

Natural-Gas Liquids.—According to the Mississippi State Oil and Gas Board, about 25 percent of the gross production of natural gas was processed in the State's three natural gasoline and cycle plants, Brookhaven Gas Cycling Plant in Lincoln County, Cranfield Gas Cycling Operations in Adams County, and Little Creek Processing Plant in Pike County.

Sun Oil Co. was building a natural gasoline plant at the new McComb field. The plant will strip butane, propane, and natural gasoline from casing-head gas. The dry gas will be sold to a gas-transmission line for a time, but plans for future disposition entail recycling the gas into the reservoir.

The Shell Oil Co. cycling plant at Little Creek, Pike County, expanded its capacity to 11 million cubic feet of solution gas a day. Addition of two compressors and extension of the gas-gathering system permitted gaslift operation of additional wells in the Little Creek field.

Anchor Petroleum Co., General Gas Corp., Skelly Oil Co., and Warren Petroleum Corp. used salt domes in Forrest County to store propane, LPG, and butane. Total storage capacity, as of October

TABLE 4.—Marketed production of natural gas[1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1950–54 (average)	148, 360	$10, 363	1957	169. 967	$17, 507
1955	163, 167	15, 664	1958	160, 143	22. 260
1956	185, 137	18, 143	1959 [2]	178, 000	24, 900

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.
[2] Preliminary figures.

TABLE 5.—Natural-gas liquids produced

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	31, 424	$2, 324	18, 967	$747	50, 391	$3, 071
1955	22, 382	1, 573	12. 242	396	34, 624	1, 969
1956	24, 829	1. 751	10, 698	580	35, 527	2. 331
1957	25, 152	1, 469	10, 044	472	35, 196	1, 941
1958	25. 738	1, 658	9, 208	503	34, 946	2, 161
1959	23, 207	1, 495	8, 141	465	31, 348	1, 960

1959, was as follows: Propane, 485,700 barrels; butane, 315,000 barrels; and LPG, 1,450,000 barrels.[4]

Petroleum.—Crude petroleum production increased 21 percent in quantity and 20 percent in value—a record 48 million barrels valued at $136 million. Mississippi ranked ninth in oil production.

Well completions increased 53 percent over 1958, compared with a National increase of 4 percent; about 60 percent were development wells.

Kaiser Aluminum & Chemical Corp. announced plans to build a plant near Purvis for calcining petroleum coke to be used by company aluminum-reduction plants in making carbon anodes for electrolytic cells. Raw material would be supplied to the new plant by Purvis refinery of Pontiac Eastern Corp. Capacity would be about 70,000 pounds of coke per year.

Approximately 15 percent (16 percent in 1958) of the total crude petroleum produced was refined at three plants: Southland Oils, Inc., at Rogers Lacy, Paluxy Asphalt Co. at Crupp Station, and Pontiac Eastern Corp. at Purvis. Statewide petroleum-refining capacity was 16,200 barrels per calendar day.

TABLE 6.—Production of crude petroleum

(Thousand barrels and thousand dollars)

Year	Production	Value
1950–54 (average)	36,289	$84,386
1955	37,741	92,840
1956	40,824	100,019
1957	38,922	113,263
1958	39,512	113,004
1959 [1]	47,928	136,116

[1] Preliminary figure.

TABLE 7.—Indicated demand, production, and stocks of crude petroleum in 1959, by months, in thousand barrels

Month	Indicated demand	Production	Stocks originating in Mississippi
January	3,746	3,734	2,371
February	3,360	3,329	2,340
March	3,782	3,799	2,357
April	3,764	3,770	2,363
May	4,182	3,916	2,098
June	3,676	3,866	2,288
July	3,950	4,026	2,364
August	4,408	4,197	2,151
September	4,514	4,076	1,713
October	3,982	4,398	2,129
November	4,151	4,281	2,259
December	4,435	4,536	2,360
Total:			
1959	47,950	[1] 47,928	----------
1958	39,590	39,512	----------

[1] Preliminary figure.

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[4] Oil and Gas Journal: Vol. 57, No. 40, Sept. 28, 1959, p. 77.

TABLE 8.—Production of crude petroleum, by fields, in thousand barrels

[Oil and Gas Journal]

Field	1955	1956	1957	1958	1959[1]
Baxterville	5,301	5,874	4,939	4,993	5,843
Bolton	-----	842	1,148	1,248	1,380
Brookhaven	3,511	3,019	2,541	2,218	1,920
Bryan	-----	-----	-----	-----	1,222
Cranfield	1,497	1,299	1,206	982	840
Diamond	-----	-----	-----	959	1,040
Eucutta	1,355	1,484	1,318	1,611	1,559
Heidelberg	3,253	3,641	3,395	2,916	3,672
La Grange and South	2,128	2,137	1,936	1,649	1,714
Little Creek	-----	-----	-----	1,440	5,896
Mallalieu	1,117	1,021	841	739	744
Maxie-Pistol Ridge	690	998	1,277	1,185	1,207
Raleigh	-----	-----	-----	-----	2,168
Soso	3,110	4,289	4,241	4,174	4,651
Tinsley	4,475	4,399	3,884	3,830	3,532
Yellow Creek	1,433	1,494	1,323	1,054	428
Other fields[2]	9,871	10,327	10,873	10,514	10,112
Total	37,741	40,824	38,922	39,512	47,928

[1] Preliminary figures.
[2] Bureau of Mines data.

NONMETALS

Argon.—Spencer Chemical Co. started a high-purity argon-production facility (3 million cubic feet a month) at its Vicksburg works. Argon, an inert gas present in the air, is used chiefly in shielded arc welding and other processes requiring completely inert atmosphere. The company recovered the gas downstream from its air-separation plant, using gases from liquid nitrogen purification.

Cement.—Production of portland cement increased significantly during the year, resulting from output of the new Mississippi Valley Portland Cement Co. plant at Redwood. Marquette Cement Manufacturing Co. produced portland and masonry cement at Brandon.

TABLE 9.—Shipments of portland cement to Mississippi from mills

Year	Mississippi (thousand barrels)	Change, percent	
		In Mississippi	In United States
1950–54 (average)	1,700	−0.4	+6.0
1955	1,887	+7.8	+6.4
1956	1,977	+4.8	+5.6
1957	2,188	+10.7	−6.4
1958	2,778	+26.9	+6.4
1959	3,072	+10.6	+9.3

Clays.—The total clay mined in 20 counties attained a record high in both quantity and value. Increased production and value of miscellaneous clay, bentonite, fire clay, fuller's earth and ball clay were noted for the year.

Bentonite production (reported from Itawamba, Monroe, Pearl River, and Smith Counties) increased in tonnage and value, reflecting an increase in unit value. Bentonite was used principally as a binder in foundry and steel works moldmaking and as a filtering and decolorizing agent.

Miscellaneous clay was more than half of the clay production in the State and was used to manufacture heavy clay products and lightweight aggregate.

Ball clay in Panola County and fuller's earth in Tippah County were mined for use in glass refractories and absorbents, respectively.

TABLE 10.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	238	$2,107	63	$690	272	$279	573	$3,076
1955	227	2,558	80	959	394	396	701	3,913
1956	219	2,360	94	931	299	299	612	3,590
1957	220	2,372	101	968	295	295	616	3,635
1958	177	2,081	106	964	293	293	576	3,338
1959	200	2,494	117	1,138	430	432	747	4,064

Atlas Tile & Brick Co. began constructing a $1 million face-brick plant at Shuqualak in Noxubee County. Initial production of the 450-foot kiln and drier will be 50,000 brick per day. Using local clay, textured face brick will be manufactured in buff and other light colors. Completion was scheduled for mid-1960.

Magnesium Compounds.—H. K. Porter Company, Inc., plant near Pascagoula began production of magnesium compounds and basic refractories—new commodities for Mississippi. The operation included both a chemical-processing plant for making periclase and a brick- and specialty-manufacturing plant. Raw materials used were sea water, dolomite, and chrome ore.

Sand and Gravel.—The Mississippi sand and gravel industry continued the upward trend started in 1958 and increased about 15 percent in quantity and 24 percent in value. Increased use of sand and gravel as construction material and in State highways caused the growth of the industry.

As in 1958, production of sand and gravel was reported from 24 of the 82 counties. Leading counties, in order of value, were: Copiah, Hinds, Washington, Adams, and De Soto. Based upon tonnage, 78 percent of the output was used for roadbuilding and maintenance,

TABLE 11.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	2,761	$2,211	473	$301	3,234	$2,512
1955	5,027	4,336	598	267	5,625	4,603
1956	4,991	4,554	324	147	5,315	4,701
1957	4,484	3,920	688	424	5,172	4,344
1958	5,614	5,149	931	1,091	6,545	6,240
1959	6,921	7,199	599	544	7,520	7,743

19 percent for other construction purposes, and 3 percent for railroad ballast and miscellaneous uses. About 90 percent of the total sand and gravel consumed was washed.

Sodium Compounds.—American Potash & Chemical Corp. was increasing the sodium chlorate capacity of its Aberdeen plant to 22,500 tons a year. Scheduled for completion in October 1960, the cost of the expansion was to be about $1.25 million. Important markets for sodium chlorate were in pulp-paper production, agriculture, uranium-ore processing, and solid-propellant fuel.

METALS

Aluminum.—Delta Architectural Products Co. announced plans to locate a new plant at Cleveland for the manufacture of aluminum fabrications and other metallic products. The community will provide a 50,000-square-foot plant through provisions of the BAWI program.

REVIEW BY COUNTIES

Adams.—Natchez Gravel Co. produced structural sand and gravel for the building industry. St. Catherine Gravel Co. operated a stationary plant to produce sand and gravel for both paving and structural purposes. Two new oilfields, West Deerfield and Southeast Fairview, were discovered as a result of exploratory drilling. Development well drilling added 19 oil wells to producing fields during the year.

Alcorn.—Corinth Brick & Tile Co. manufactured building brick from miscellaneous clay mined near Corinth.

Bolivar.—The stationary plant of Clay Carter Gravel Co. produced washed gravel for road construction.

Carroll.—Delta Brick & Tile Co., Inc., manufactured building brick from miscellaneous clay mined near Carrollton. LeFlore County Engineer produced pit-run gravel for road construction.

Chickasaw.—Two small gasfields, Trebloc and Coleville, accounted for county mineral production. Baldwyn Brick & Tile Co. completed a relatively small brick plant at Okolona.

Clay.—Structural and paving sand and gravel were produced by West Point Gravel Co. The State of Mississippi Lime Plant Board continued as the State sole producer of agricultural limestone.

Copiah.—Production of paving sand and gravel was reported by Traxler Gravel Co., Inc., Greene Brothers Gravel Co., Inc., and Lewis Gravel Co. Gravel for railroad ballast was furnished by Gatesville Gravel Co.

De Soto.—Stationary plants of Memphis Stone & Gravel Co. and Weymouth Construction Co. produced paving sand and gravel.

Forrest.—American Sand & Gravel Co. produced sand and gravel for building and paving, engine sand, and railroad ballast. Pittman Concrete & Gravel Co. produced structural and paving sand and gravel. Hattiesburg Brick Works used miscellaneous clay in making face brick and structural tile. Development well drilling in the Pistol Ridge-Maxie field was outstanding in successful completions during the year. The county ranked first in natural gas production.

TABLE 12.—Value of mineral production in Mississippi, by counties[1]

County	1958	1959	Minerals produced in 1959, in order of value
Adams	$23,080,834	$22,541,652	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Alcorn	(2)	(2)	Clays.
Amite	48,311	52,589	Petroleum, natural gas.
Attala	3,375	(2)	Clays.
Bolivar	63,482	63,450	Sand and gravel.
Carroll	51,152	123,000	Sand and gravel, clays.
Chickasaw	86,325	35,248	Natural gas.
Clarke	519,851	753,337	Petroleum, natural gas.
Clay	91,531	137,976	Sand and gravel, natural gas, petroleum.
Coahoma	(2)	------------	
Copiah	605,327	1,515,007	Sand and gravel.
De Soto	528,781	(2)	Do.
Forrest	12,367,979	12,946,666	Natural gas, petroleum, sand and gravel, clays.
Franklin	2,665,682	3,266,750	Petroleum, natural gas.
George	(2)	(2)	Sand and gravel.
Greene	4,824	4,529	Petroleum.
Grenada	(2)	(2)	Sand and gravel.
Hancock	625,581	398,753	Natural gas, petroleum.
Harrison	9,745	(2)	Sand and gravel.
Hinds	3,966,778	4,746,544	Petroleum, sand and gravel, clays, natural gas.
Holmes	(2)	(2)	Sand and gravel.
Itawamba	(2)	(2)	Clays.
Jackson	------------	(2)	Magnesium compounds.
Jasper	15,359,796	16,070,435	Petroleum, natural gas.
Jefferson	6,137,953	6,027,581	Do.
Jefferson Davis	4,998,611	4,154,980	Natural gas, petroleum.
Jones	4,031,096	7,361,522	Petroleum, natural gas, clays.
Lamar	10,573,429	11,920,972	Petroleum, natural gas.
Lauderdale	(2)	(2)	Clays.
Lee	(2)	(2)	Do.
Lincoln	15,508,989	21,524,523	Petroleum, natural gas, natural-gas liquids, clays.
Lowndes	703,330	660,545	Sand and gravel, clays.
Madison	1,068,570	964,584	Petroleum, natural gas.
Marion	2,108,404	2,613,056	Petroleum, natural gas, sand and gravel.
Marshall	140,000	(2)	Clays.
Monroe	2,885,298	3,873,096	Clays, natural gas, petroleum, sand and gravel.
Noxubee	45,900	56,794	Stone.
Panola	(2)	(2)	Clays.
Pearl River	3,838,495	4,113,296	Natural gas, petroleum, sand and gravel, clays.
Perry	(2)	(2)	Sand and gravel, petroleum.
Pike	1,271,837	8,298,786	Petroleum, natural-gas liquids, natural gas.
Pontotoc	(2)	(2)	Clays.
Prentiss	(2)	(2)	Do.
Rankin	(2)	(2)	Cement.
Scott	------------	132,258	Petroleum, natural gas.
Sharkey	8,375	5,766	Petroleum.
Simpson	1,672,451	3,460,150	Petroleum, natural gas.
Smith	4,685,491	10,047,737	Petroleum, clays, natural gas.
Sunflower	(2)	5,750	Clays.
Tippah	(2)	(2)	Do.
Tishomingo	------------	142,110	Sand and gravel.
Walthall	63,313	390,888	Petroleum, natural gas.
Warren	------------	(2)	Cement.
Washington	875,066	932,000	Sand and gravel.
Wayne	9,312,193	9,291,137	Petroleum, natural gas.
Webster	(2)	------------	
Wilkinson	2,890,695	2,950,438	Petroleum, natural gas.
Yalobusha	(2)	(2)	Sand and gravel.
Yazoo	11,236,969	9,507,897	Petroleum, sand and gravel, natural gas.
Undistributed	7,284,670	9,149,603	
Total	151,412,114	181,086,060	

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[1] Following counties were not listed because no production was reported: Benton, Calhoun, Choctaw, Claiborne, Covington, Humphreys, Issaquena, Kemper, Lafayette, Lawrence, Leake, Le Flore, Montgomery, Neshoba, Newton, Oktibbeha, Quitman, Stone, Tallahatchie, Tate, Tunica, Union, and Winston.

[2] Value included with "Undistributed".

Hancock.—A new oilfield, Kiln, was discovered in November. Development wells extended the known boundaries of the Ansley field.

Hinds.—Miss-Lite Aggregate Division of Jackson Ready-Mix Concrete Co. used miscellaneous clay in the production of lightweight aggregate. Johnson-Cone Brick Co. and Tri-State Brick & Tile Co. manufactured building brick and other heavy clay products. Development drilling in the Bolton oilfield was markedly productive. The 235,000-kilowatt electric-generating unit added to the Rex Brown steam-electric station at Jackson was completed during the year.

Holmes.—Hammett Gravel Co. reported production of paving sand and gravel from an open pit near Lexington.

Itawamba.—The county ranked third in value of clays produced. American Colloid Co. processed bentonite for moldmaking in foundries and steelworks.

Jackson.—H. K. Porter & Co., Inc., plant at Pascagoula produced magnesia from sea water. Coastal Chemical Corp. produced nitrogen compounds for agricultural and industrial uses.

Jasper.—Oil production from the Heidelberg and Soso oilfields was sufficient to rank the county as the State's third largest petroleum producer.

Jefferson.—Oil and gas production from the county remained at the 1958 level. Exploration drilling was active but unproductive.

Jefferson Davis.—Production from the Gwinville field retained the county rank as the second largest natural gas producer in the State. A new gasfield, Grange, was discovered in May by Pan American Petroleum Corp.

Jones.—Laurel Brick & Tile Co., Inc., reported production of miscellaneous clay for use in manufacturing building and face brick. A new oilfield, Laurel, was discovered in January by Central Oil Co. Development drilling in Bryan oilfield, discovered in 1958, was markedly successful inasmuch as 30 of the 33 wells drilled were productive.

Lamar.—The Baxterville oil and gas-condensate field in the southwest corner of the county continued as a major producer, ranking fifth in production of natural gas and fourth in petroleum production. Development drilling during the year extended the known boundary of the field.

Lee.—Tupelo Brick & Tile Co. reported mining miscellaneous clay for use in making building brick.

Lincoln.—Brookhaven Pressed Brick & Manufacturing Co. reported the manufacture of building brick and heavy clay products from miscellaneous clay. Development drilling in Little Creek oilfield, discovered in 1958, was very productive. The county became the leading petroleum producer in the State.

Lowndes.—Sand and gravel for road construction, building, and various minor uses was produced by C & P Gravel Co., Columbus Gravel Co., Fleming Gravel Co., and Smith Gravel Co. Columbus and Greenville Railway Co. produced engine sand and railroad ballast gravel. Columbus Brick Co. manufactured building brick from miscellaneous clay.

Marion.—Pit-run gravel was mined by the county road department for maintenance and construction of county roads. Exploratory drilling resulted in discovery of a new oilfield (East Dexter). Hub oil and gas-condensate field and Sandy Hook gas-condensate field were the most important producers.

Marshall.—Clay Products, Inc., built and began operating a new brick plant at Holly Springs. The self-charging kiln was 259 feet long and was designed for 30,000 brick a day. Miscellaneous clay from the plant vicinity was used to make light-colored face brick. Holly Springs Brick & Tile Co. added a tunnel kiln to augment the periodic kilns already in operation. Southern Brick & Tile Co. mined miscellaneous clay for manufacturing building brick.

Monroe.—The county retained the lead in value of clay produced; the entire output was bentonite. American Colloid Co. and Eastern Clay Products Department of the International Minerals & Chemical Corp. supplied bentonite chiefly for moldmaking use in foundries and steelworks. Filtrol Corp. processed bentonite for filtering and decolorizing uses. Hamilton Sand & Gravel Co. and Nash Contracting Co. produced sand and gravel for paving and structural work. The county ranked fourth in natural gas production.

Noxubee.—The State of Mississippi Lime Plant Board was the only producer of agricultural lime.

Panola.—Ranking fourth in the value of clay produced, Kentucky & Tennessee Clay Co. mined ball clay for glass-refractory use.

Pearl River.—Pearl River Clay Co. mined bentonite for use as rotary-drilling mud, in insecticides, and in fungicides. Williams Gravel Co. dredged and processed sand and gravel for structural uses. A new gasfield, South Stewart, was discovered in early September. Development drilling around the Pistol Ridge field was very successful in opening both oil and gas wells. As a result, the county ranked third among State natural gas producers.

Perry.—The Underwood Sand & Gravel Co. dredged and processed sand and gravel for structural and paving uses. A small quantity of petroleum was produced from the Glazier oilfield.

Pike.—Increased activity in exploratory and development drilling resulted in discovery of two new oilfields, Summit and McComb, and many more producers in the year-old Little Creek oilfield.

Pontotoc.—Pontotoc Brick Co. mined miscellaneous clay for use in building brick.

Prentiss.—Baldwyn Brick & Tile Co. made building brick from locally mined miscellaneous clay.

Rankin.—Marquette Cement Manufacturing Co. produced portland and masonry cement at its Brandon plant. Calcareous marl was used in the process.

Scott.—Exploratory drilling by Shell Oil Co. resulted in discovery of Morton oilfield—the county's first. Development drilling in the new field opened three more producing wells before September. Production was from 6.400 feet in Eutaw sand.

Simpson.—Exploratory and development drilling was markedly successful in Simpson County. A new oilfield, Merit, was discovered by Jett Drilling Co., Inc. Extensions of the new field and the older Magee and Martinville fields were found by various operators.

Smith.—Filtrol Corp. operated the Burns mine to produce bentonite for use in filtering and decolorizing mineral oils, vegetable oils, and animal fats. Development drilling was extremely successful during the year inasmuch as 19 producers—11 dual completions—resulted from the 20 wells drilled. The total value of petroleum production in Smith County was more than double that of 1958.

Tippah.—The county ranked second in value of clay produced. Two companies, Wyandotte Chemical Corp. and Howell Southern Products, Inc., quarried and processed fuller's earth for absorbent uses.

Tishomingo.—Tri-State Sand Co., near Tishomingo City, mined and processed a sand, containing a natural admixture of bonding clay for use in foundries and steelworks.

Walthall.—Gulf Coast Drilling & Exploration, Inc., discovered a new oilfield (West Dexter) in October. Skelly Oil Co. and Kin-Ark Oil Co. drilled several successful development wells for a sixfold increase in value of oil and gas produced in the county.

Warren.—The value of portland cement produced by Mississippi Valley Portland Cement Co. at Redwood reached a significant total by yearend. The company announced plans to double the capacity of the plant.

Washington.—The county ranked third in value of sand and gravel produced during the year. The U.S. Army Corps of Engineers used large quantities of locally produced sand and gravel for riverbank stabilization near Vicksburg. Brent Contracting Co., Inc., Greenville Dredging Co., and Greenville Gravel Co. produced sand for building and paving purposes and gravel for building, paving, and fill. Pesticides were manufactured by Olin Mathieson Chemical Corp. at its plant near Leland.

Wayne.—A new oilfield, Thompson's Creek, was discovered in April by Placid Oil Co. and, by yearend, two successful development wells, both dual completions, had been drilled in the new field. Major fields contributing to oil and gas production in the county were Eucutta, Yellow Creek, and Diamond.

Wilkinson.—Many small fields accounted for a moderate oil and gas production in the county. Exploratory drilling during 1959 was unsuccessful.

Yalobusha.—Grenada Gravel Co. operated a stationary plant near Scobey to produce building and paving sand and gravel.

Yazoo.—Anderson Sand & Gravel Co. quarried pit-run gravel for county highway maintenance and construction. Mississippi Chemical Corp. produced nitrogen compounds. Oil and gas from the Tinsley field was the major contributor to the value of mineral production in the county.

The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Division of Geological Survey and Water Resources, Department of Business Administration of Missouri

By W. G. Diamond[1] and William C. Hayes[2]

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MINERAL production in 1959 totaled $157 million, a 9-percent increase over 1958. Missouri ranked first in lead production in the Nation for the 52d consecutive year. Mineral output was reported from 107 of the 114 counties. Leading counties in order of production value were St. Louis, St. Francois, Ste. Genevieve, Cape Girardeau, and Jackson. Seventeen mineral commodities were produced in the State—seven metals, eight nonmetals, and two mineral fuels. The five principal mineral commodities in order of value were cement, stone, lead, lime, and coal. Nonmetals comprised 73 percent of the total value, metals 19 percent, and mineral fuels 8 percent.

TABLE 1.—Mineral production in Missouri[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	199,268	$2,666	296,093	$3,924
Cement ... thousand 376-pound barrels	12,116	40,657	13,947	46,975
Clays ... thousand short tons	2,060	5,986	2,635	6,898
Coal ... do	2,592	11,111	2,748	11,937
Copper (recoverable content of ores, etc.)	1,429	752	1,065	654
Iron ore (usable) ... thousand long tons, gross weight	387	3,820	349	3,278
Lead (recoverable content of ores, etc.)	113,123	26,471	105,165	24,188
Lime ... thousand short tons	1,173	14,136	1,324	15,714
Sand and gravel ... do	8,972	9,728	10,280	11,406
Silver (recoverable content of ores, etc.) thousand troy ounces	251	227	340	308
Stone ... thousand short tons	24,276	32,878	26,939	36,435
Zinc (recoverable content of ores, etc.)	362	74	92	21
Value of items that cannot be disclosed: Native asphalt, cobalt, gem stones, manganese ore, nickel (content of ore) and petroleum (1959)		[2] 2,032		2,108
Total Missouri[3]		[2] 144,120		157,009

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.
[3] Total adjusted to eliminate duplicating value of clays and stone.

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A highlight of 1959 was continued development of the Viburnum lead deposits and the Pea Ridge iron ore deposit. Expenditures at Viburnum totaled more than $8 million. Completion of the first 3,000-ton unit of the 6,000-ton mill was expected by May 1960. Although progress at Pea Ridge was delayed by a strike from April to December, the service shaft had reached a depth of 1,681 feet and the main ore hoisting shaft 439 feet at yearend.

Monsanto Chemical Co. announced plans for construction of a centralized research center at the company general offices in Creve Coeur, near St. Louis, at a cost of more than $10 million. Various widely scattered research activities would be centralized in a group of connected buildings, which would include laboratories, a library, and supporting facilities. Research in plastics, organic chemicals, and inorganic chemicals would be conducted. Completion of the center was expected in 1961.

Employment and Injuries.—Average annual employment declined 7 percent in the metal industry, increased 9 percent in the nonmetal, and remained approximately the same in coal mining.

Four fatal accidents were reported in the lead and zinc mining industry, according to the Division of Mine Inspection, Department of Labor and Industrial Relations. The cause of each fatal accident is listed: (1 and 2) Bucket carrying men dropped to bottom of shaft, owing to splice failure in rope, (3) electrocution, and (4) rockfall.

Government Programs.—Government financing of exploration projects in search of strategic minerals, through the program of the Office of Minerals Exploration (OME), continued during 1959. The program included investigation of copper and lead sources in Dent and Iron Counties by American Zinc, Lead and Smelting Co., and lead, zinc, and copper sources in Crawford County by St. Joseph Lead Co. (completed in February). All other contracts reported in 1958 were completed by December 1958.

TABLE 2.—Average annual employment of mining industries[1]

Industry	1955	1956	1957	1958	1959
Metal mining	3, 371	3, 524	3, 767	3, 540	3, 300
Nonmetal mining	3, 999	3, 991	4, 030	3, 941	4, 300
Coal mining	970	921	970	[2] 800	800
Total	8, 340	8, 436	8, 767	[2] 8, 281	8, 400

[1] Division of Employment Security, Department of Labor and Industrial Relations, State of Missouri.
[2] Revised figure.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Production of barite, second highest in the Nation, totaled 296,000 tons—a 49-percent increase over 1958. Missouri led in value of shipments, with $3.9 million. Barite was mined in Washington and Jefferson Counties and processed at grinding plants in Washington and St. Louis Counties. Missouri barite was used in oil-well drilling and by chemical industries.

Cement.—Production of portland cement totaled 13.6 million barrels, an increase of 1.5 million barrels over 1958, and averaged 86 percent of total capacity. Plants in St. Louis, Cape Girardeau, Jackson, and Ralls Counties produced 56 percent of the total manufactured by wet-process and 44 percent by dry-process methods. Of 13.6 million barrels, nearly 84 percent was shipped in bulk and 16 percent in bags. More than 93 percent was transported by railroad, and the remainder by boat. Missouri Portland Cement Co. completed installation of a second finish mill at its Sugar Creek plant near Independence, and production capacity was increased to 3 million barrels per year. All plants also produced masonry cement.

TABLE 3.—Barite sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	288, 453	$2, 785, 469	1957	317, 350	$3, 938, 486
1955	363, 692	4, 003, 842	1958	199, 268	2, 666, 496
1956	381, 642	4, 461, 955	1959	296, 093	3, 923, 651

TABLE 4.—Production and shipments of portland cement

(Thousand barrels and thousand dollars)

Year	Production (quantity)	Shipments		Year	Production (quantity)	Shipments	
		Quantity	Value			Quantity	Value
1950–54 (average)	10, 300	10, 265	$26, 340	1957	10, 866	10, 794	$34, 307
1955	12, 001	12, 255	34, 912	1958	12, 143	11, 813	39, 376
1956	12, 441	12, 014	36, 888	1959	13, 610	13, 583	45, 430

TABLE 5.—Shipments of all types of finished portland and high-early strength cement to Missouri from mills

Year	Missouri (thousand barrels)	Change, percentage		Year	Missouri (thousand barrels)	Change, percentage	
		In Missouri	In United States			In Missouri	In United States
1950–54 (average)	6, 441			1957	6, 851	−10	−6
1955	7, 919	+5	+6	1958	7, 636	+11	+6
1956	7, 643	−3	+6	1959	8, 825	+16	+9

TABLE 6.—Clays sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Fire clay		Diaspore		Burley	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	1,376	$6,714	37	$573	52	$472
1955	1,486	5,693	12	134	31	208
1956	1,699	6,499	25	293	42	325
1957	1,672	6,206	10	123	50	398
1958	1,176	4,806	9	143	27	190
1959	1,623	5,630	6	93	28	197

Year	Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value
1950–54 (average)	825	$1,110	2,290	$8,869
1955	873	867	2,402	6,902
1956	892	899	2,658	8,016
1957	916	921	2,648	7,648
1958	848	847	2,060	5,986
1959	978	978	2,635	6,898

Clays.—Fire clay and high-alumina clay for refractories were produced in Missouri in 1959. Missouri fire clay is especially suitable for superduty refractories, and the State is a leader in refractories production. Companies producing refractories were Kaiser Refractories and Chemicals Division, Kaiser Aluminum and Chemicals Corp. (formerly Mexico Refractories Co.), A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., Walsh Refractories Corp., Refractories Division, H. K. Porter Co., Inc. (Laclede-Christy operations), Wellsville Fire Brick Co., General Refractories Co., North American Refractories Co., and Corhart Refractories Co., Inc. Most of the clay was mined by contractors. Fire clay for use in horizontal zinc retorts in Oklahoma and Texas was mined in Monroe County by Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. General Chemical Division of Allied Chemical Corp. mined fire clay for chemical uses. Carter-Waters Corp. mined miscellaneous clay in Platte County and produced lightweight aggregate. Miscellaneous clay also was used in manufacturing heavy clay products and cement. Clays were produced in 22 counties.

Gem Stones.—Gem varieties of agate and various other minerals were recovered in Missouri in 1959.

Lime.—Production of lime increased 13 percent over 1958, and value increased 11 percent. Approximately 84 percent of the lime was used for chemical and industrial purposes, and 16 percent for building and refractory uses. Lime was produced at six plants—two in Greene County and one each in Marion, Newton, St. Francois, and Ste. Genevieve Counties.

TABLE 7.—Lime (quick and hydrated) sold and used by producers

(Thousand short tons and thousand dollars)

Year	Quicklime (quantity)	Hydrated lime (quantity)	Total lime	
			Quantity	Value
1950–54 (average)	931	194	1,125	$11,062
1955	1,241	224	1,465	14,408
1956	1,254	227	1,482	15,814
1957	1,172	221	1,393	16,475
1958	953	220	1,173	14,136
1959	1,089	235	1,324	15,714

Perlite.—Crude perlite, mined in Western States, was expanded at a plant in St. Louis and used mainly as lightweight aggregate.

Sand and Gravel.—Sand and gravel production was reported from 73 counties, mainly from stream deposits. Almost 88 percent of total production was used for building and highway construction. St. Louis, Jefferson, Franklin, St. Charles, and Jackson Counties led in value of production. Commercial operations furnished 93 percent of total tonnage and 96 percent of total value; the remainder was Government-and-contractor output. Industrial sand was mined in St. Louis, St. Charles, and Jefferson Counties and used by glass and ceramic industries.

Stone.—Limestone, granite, marble, sandstone, and miscellaneous stone were quarried in 1959. Limestone production was reported in 82 counties and supplied 96 percent of the total tonnage and 93 percent of the total value. Dimension and crushed granite were produced in Iron County. Dimension marble was quarried in Jasper, Greene, and Ste. Genevieve Counties, and crushed marble in Jasper, Madison, and Jefferson Counties. Shannon, Vernon, and Wayne Counties supplied dimension sandstone. Miscellaneous stone (chats) was produced in St. Francois, Jasper, Newton, and Washington Counties. Crushed stone was used mainly for concrete aggregate, roadstone, riprap, and railroad ballast; dimension stone was used for monumental and building purposes. Commercial producers furnished 98 percent of total stone output.

TABLE 8.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	6,159	$5,995	944	$564	7,103	$6,559
1955	8,353	8,790	1,631	1,191	9,984	9,981
1956	8,161	8,873	1,424	1,244	9,585	10,117
1957	7,198	8,000	1,282	942	8,480	8,942
1958	8,281	9,285	691	443	8,972	9,728
1959	9,574	10,959	706	447	10,280	11,406

TABLE 9.—Stone sold or used by producers, by kinds

Year	Granite		Marble		Limestone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1955	2,821	$180	[1] 8,500	[1] $102	21,283,587	$28,850
1956	3,456	302	[1] 5,000	[1] 25	23,152,644	31,051
1957	5,369	232	(2)	(2)	20,936,499	27,269
1958	3,648	260	(2)	(2)	23,387,507	30,774
1959	3,111	276	181,070	1,704	25,980,397	33,944

Year	Sandstone		Miscellaneous stone [3]		Total stone	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1955	3,036	$59	1,070,824	$389	[1] 22,368,768	[1] $29,580
1956	(2)	(2)	1,395,776	820	24,578,243	33,577
1957	(2)	(2)	1,117,339	751	22,097,639	29,836
1958	(2)	(2)	870,879	465	24,275,550	32,878
1959	5,209	83	769,553	428	26,939,340	36,435

[1] Excludes dimension marble.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Chats; also includes small quantity of stone.

Bar-Co Roc, Inc., produced asphaltic sandstone from its pit in Barton County.

Tripoli.—The American Tripoli Division of The Carborundum Co. processed tripoli at its Seneca plant in Newton County from ore quarried in Oklahoma. Production was greater than in 1958.

Vermiculite.—Crude vermiculite from Western States was exfoliated at plants in St. Louis and Jackson Counties.

METALS

Mine Mills and Smelters.—St. Joseph Lead Co. operated its Herculaneum lead smelter and refinery throughout 1959. At Fredericktown, National Lead Co. refined cobalt-nickel ore. National Lead Co. operated its mine mill in Madison County; St. Joseph Lead Co. operated its Indian Creek mill in Washington County and its Federal, Bonne Terre, Desloge, and Leadwood mills in St. Francois County. The Mine La Motte mill of Mine La Motte Corp. was idle all year; development operations were halted in February.

Cadmium, Gallium, Germanium, and Indium.—These metals occurred in Missouri lead-zinc ores and were recovered from zinc smelter flue dusts. Since no source was designated for any of the concentrate smelted in Missouri, no State of origin was assigned for these byproduct metals.

Cobalt and Nickel.—National Lead Co. recovered cobalt and nickel from complex lead-copper-cobalt-nickel ores in Madison County. The refinery at Fredericktown was leased from the U.S. Government.

Columbium-Tantalum and Uranium.—Domestic euxenite concentrate, mostly from Idaho, was processed by Mallinckrodt Chemical Works, which formed a subsidiary, Mallinckrodt Nuclear Corp., to assume functions of its special metals. Mallinckrodt Nuclear Corp. was awarded a contract to supply uranium fuels for the 15,000-kw. nuclear-reactor powerplant under construction at Kahl, West Germany. The contract called for about 20,000 pounds of uranium dioxide. The company Hematite plant will refine the gaseous uranium hexafluoride into the solid uranium dioxide. The plant will also process a highly enriched uranium dioxide for the world's first nuclear-powered merchant ship.

Copper.—Missouri produced a small quantity of copper from lead-copper ore in Madison County and lead ore in St. Francois County. Output was less than in 1958.

Iron Ore.—Development of the Pea Ridge iron ore body continued, although delayed by a strike that started in April and ended in December. As a result, the starting of operations was postponed until May, 1963. Construction of the branch railroad connecting with the Missouri Pacific Railroad main line continued. The operating company, Meramec Mining Co., was owned jointly by Bethlehem Steel Corp. and St. Joseph Lead Co.

Joint exploration by American Zinc, Lead and Smelting Co. and Granite City Steel continued. According to the American Zinc, Lead and Smelting Co. 1959 Annual Report, 7 deep exploratory holes were completed, making a combined total of 26 holes completed with an aggregate of 61,582 feet. No holes had been drilled deeper than 3,500 feet. A commercial thickness and grade of iron and copper ore was indicated at Boss-Bixby, and of iron ore only at Bourbon.

Armco Steel Corp., Sheffield Division, took options on property in Jackson and Lafayette Counties for core drilling and prospecting for iron ore. The area was selected as a result of an airborne magnetometer survey.

The Missouri State Legislature enacted a new metal mining code, enabling the Meramec Mining Co. to keep abreast of mechanized mining when the Pea Ridge iron mine is brought into production.

Brown-ore (limonite) and hematite-ore output declined 10 percent in tonnage and 14 percent in value from 1958. Production was reported from 13 mines in 7 counties.

Iron and Steel.—The Sheffield Division plant of Armco Steel Corp. began operating its $10 million rodmill at Kansas City. The company also operated its open hearth and electric furnaces.

Iron and steel foundries, principally in the St. Louis and Kansas City areas, consumed iron and steel scrap and pig iron, and produced iron and steel castings.

TABLE 10.—Mine production of silver, copper, lead, and zinc, in terms of recoverable metals

Year	Mines producing	Material sold or treated		Silver		Copper	
		Crude ore (short tons)	Old tailing (short tons)	Fine ounces	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)		6,656,951	1,484,685	330,176	$299	2,456	$1,232
1955	18	6,734,346	1,546,126	268,620	243	1,722	1,285
1956	19	6,996,696	1,223,575	295,111	267	1,890	1,607
1957	16	6,874,008	1,271,684	183,427	166	1,604	966
1958	9	5,945,836	479,916	250,917	227	1,429	752
1959	4	5,573,517		339,760	308	1,065	654

Year	Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	127,743	$37,614	9,758	$2,913	$42,058
1955	125,412	37,373	4,476	1,101	40,002
1956	123,783	38,868	4,380	1,200	41,942
1957	126,345	36,135	2,951	684	37,951
1958	113,123	26,471	362	74	27,524
1959	105,165	24,188	92	21	25,171

TABLE 11.—Mine production of silver, copper, lead, and zinc in 1959, by classes of ore or other sources of material, in terms of recoverable metals

Source	Number mines	Material sold or treated (short tons)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lead ore [1]	4	5,573,517	339,760	1,065	105,165	92

[1] Includes lead-copper ore from one mine.

TABLE 12.—Mine production of lead and zinc in southeastern and central Missouri, in terms of concentrates and recoverable metals [1]

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite) [2]		Recoverable metal content [3]			
					Lead		Zinc	
	Short tons	Value [4] (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	182,231	$30,127	4,872	$447	125,877	$37,024	2,809	$794
1955	180,262	32,428	7,507	700	125,357	37,356	3,934	968
1956	174,131	33,266	6,484	542	123,395	38,746	3,345	917
1957	179,312	31,507	5,903	448	126,323	36,128	2,866	665
1958	159,068	23,015	770	41	113,123	26,471	362	74
1959	146,765	21,698	206	12	105,165	24,188	92	21

[1] Based on southeastern and central Missouri ore "dirt" and old tailing treated at mills.

[2] Includes zinc-lead carbonate concentrate.

[3] In calculating metal content of ores from assays, allowance has been made for smelting losses. In comparing values of concentrate "ore" and metal, value for concentrate is that received by producer, whereas value of lead and zinc is calculated from average price for all grades.

[4] Values are arbitrary, because part of lead concentrate is smelted by producer.

TABLE 13.—Mine production of lead and zinc in southwestern Missouri, in terms of concentrate and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950–54 (average)	[3] 2,402	[3] $494,051	[4] 12,847	[4] $1,307,605	1,866	$589,474	6,949	$2,116,643
1955	75	12,750	1,048	74,528	55	16,390	542	133,332
1956	496	102,096	1,862	161,502	388	121,832	1,035	283,590
1957	29	5,576	161	12,742	22	6,292	85	19,720
1958–59	----------	----------	----------	----------	----------	----------	----------	----------

[1] Based on southwestern Missouri ore "dirt" and old tailing treated at mills.

[2] In calculating metal content of ores from assays, allowance has been made for smelting losses. In comparing values of concentrate "ore" and metal, value for concentrate is that received by producer, whereas value of lead and zinc is calculated from average price for all grades.

[3] Includes lead carbonate.

[4] Includes zinc silicate.

TABLE 14.—Tenor of lead and zinc ore, old tailing, and slimes milled and concentrate produced, by district

	Southeastern Missouri	
	1958	1959
Concentrate production:		
Lead ... short tons	159,068	146,765
Zinc ... do	770	206
Concentrate obtained from:		
Lead ... percent	2.48	2.63
Zinc ... do	.01	.004
Metal content of ore: [1]		
Lead ... do	1.76	1.89
Zinc ... do	.01	.002
Average lead content of galena concentrate ... do	72.57	73.12
Average zinc content of sphalerite concentrate ... do	52.21	49.51
Average value per ton:		
Galena concentrate	$144.69	$147.84
Sphalerite concentrate	$53.79	$56.68
Total material milled ... short tons	[2] 6,425,752	5,573,517

[1] Figures represent metal content of crude ore only as recovered in concentrate; data on tailing losses not available.

[2] Includes lead-copper ore and 479,916 tons of old tailing remilled.

Lead.—Mine production of recoverable lead in Missouri totaled 105,000 tons—41 percent of Nation's lead production. Southwestern Missouri reported no output for the second consecutive year. Production value declined slightly as the price dropped from 13 cents per pound (New York) January 1 to 11 cents February 24; fluctuated between 11 and 11½ cents; advanced to 12 cents May 7 and 13 cents August 24; and dropped to 12 cents by December 21, where the price remained. Because of the continued depressed condition of the lead market and excessive inventories, St. Joseph Lead Co. reduced the workweek in southeastern Missouri to 4 days from February 16 until August 6. St. Joseph Lead Co. continued development of its Viburnum lead mine in southeastern Missouri. Ore reserves were expanded, and construction of the company town of Viburnum proceeded on schedule as company expenditures exceeded $8 million.

Silver.—Silver was recovered by refining pig lead obtained in smelting lead and lead-copper ores from Madison and St. Francois Counties.

Silicon.—Monsanto Chemical Co. began constructing a plant near St. Louis to manufacture ultrapure silicon metal to be used in making transistors and rectifiers.

Zinc.—The decline in production of recoverable zinc continued for the seventh consecutive year. No zinc was produced in southwestern Missouri for the second consecutive year. Production was reported from Washington County. The price of Prime Western slab zinc was 11½ cents per pound (East St. Louis) January 1, 11 cents February 25, 12 cents September 21, between 12 cents and 13 cents from October 21 to October 29, and at 12½ cents November 2 to yearend.

TABLE 15.—**Mine production of silver, copper, lead, and zinc in 1959 by months, in terms of recoverable metals**

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	28,200	88	9,749	6
February	28,300	92	8,458	5
March	28,400	98	7,944	8
April	28,500	106	8,104	8
May	28,300	77	7,254	7
June	28,300	87	8,187	10
July	28,200	78	8,191	10
August	28,300	82	9,693	10
September	28,300	86	9,605	12
October	28,300	107	9,903	8
November	28,300	83	8,703	4
December	28,360	81	9,374	4
Total:				
1959	339,760	1,065	105,165	92
1958	250,917	1,429	113,123	362

TABLE 16.—**Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1959**

[E&MJ Metal and Mineral Markets]

Zinc concentrate		Lead concentrate	
Period	Price per short ton	Period	Price per short ton
Jan. 1–Feb. 24	$68	Jan. 1–Jan. 21	$156.12
Feb. 25–Sept. 20	64	Jan. 22–Feb. 10	141.72
Sept. 21–Oct. 5	68	Feb. 11–Feb. 23	134.52
Oct. 6–Oct. 21	72	Feb. 24–Mar. 4	127.32
Oct. 22–Nov. 1	80	Mar. 5–Mar. 31	134.52
Nov. 2–Dec. 31	76	Apr. 1–Apr. 19	127.32
		Apr. 20–May 6	134.52
		May 7–Aug. 23	141.72
		Aug. 24–Dec. 13	156.12
		Dec. 14–Dec. 20	148.92
		Dec. 21–Dec. 31	141.72

TRI-STATE DISTRICT

No production was reported in the southwestern Missouri part of the Tri-State District. Beneficiation of sulfide-oxide lead-zinc ore from Jasper County, Mo., was the object of mineral-dressing research to develop new or improved concentration processes for oxidized or partly oxidized lead and zinc ores.[3] The low-grade ore, containing galena, cerussite, pyromorphite, hemimorphite, smithsonite, and sphalerite was concentrated by froth flotation and tabling to a grade of 66 percent lead. Because of the high content of slime-sized values, overall recovery was only 64 percent. Tests to recover zinc by froth flotation and by gravity concentration were unsatisfactory.

TABLE 17.—Consumption of ferrous scrap and pig iron, in short tons

Year	Total scrap	Pig iron	Total scrap and pig iron
1955	1,017,473	51,864	1,069,337
1956	1,039,866	45,722	1,085,588
1957	976,266	51,932	1,028,198
1958	896,231	36,257	932,488
1959	843,155	73,518	916,673

Application of electrical-resistivity surveys to exploration for zinc-lead deposits in the Racine-Spurgeon area in Newton County, Mo., was discussed in a Bureau of Mines report.[4] The Bureau of Mines completed 53 miles of reconnaissance electrical-resistivity profiling and 76 test holes aggregating 23,896 feet of churn drilling. Test drilling showed that most resistivity readings are related to the geology of the area and, in a few places, to the topography. The resistivity survey, combined with a study of topographic relationships, indicated favorable areas in which to search for zinc-lead ore deposits. (Details of Tri-State activity may be found in the Oklahoma chapter.)

MINERAL FUELS

Coal.—Bituminous coal was produced in 17 counties; more than 1,000 tons was reported from each of 39 mines. Twelve underground mines in five counties supplied 4 percent of the State total tonnage and value. Nearly all underground production was cut by machines; 84 percent was power drilled. Strip-mine production reported from 27 mines in 14 counties supplied 97 percent of total tonnage and value. Total overburden excavated, nearly 40.4 million cubic yards, averaged 16 cubic yards for each ton of coal strip mined. At nine mines, 70 percent of total coal tonnage was mechanically cleaned, and at 12 mines over 67 percent of the mined coal was crushed. Three percent of the coal at seven mines was oil treated.

TABLE 18.—Coal production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	2,819	$11,540	1957	2,976	$12,691
1955	3,232	12,772	1958	2,592	11,111
1956	3,283	13,223	1959	2,748	11,937

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[3] Powell, H. E., Beneficiating A Complex Sulfide-Oxide Lead-Zinc Ore From Missouri: Bureau of Mines Rept. of Investigations 5564, 1960, 10 pp.

[4] Chester, J. W., Application of Electrical-Resistivity Surveys to Exploration for Zinc-Lead Deposits, Racine-Spurgeon Area, Newton County, Mo.: Bureau of Mines Rept. of Investigations 5503, 1960, 57 pp.

Petroleum.—Standard Oil Co. (Ind.) announced plans to construct a marine terminal on the Missouri River 4 miles northwest of Jefferson City, scheduled for completion and operation in 1960. Facilities would include a barge unloading dock, four storage tanks with a capacity of 142,000 barrels, and a truck-transport loading dock. Products would be supplied from the company Wood River (Ill.) refinery. Workers at the company Sugar Creek refinery near Kansas City struck early in July. Part of the plant was operated by supervisors and other management personnel. Gulf Oil Co. completed construction of its $1.25 million marine-service bulk plant at St. Louis.

Crude petroleum was recovered near St. Louis and near Tarkio in Atchison County. The Currie No. 1, a wildcat well drilled by William Gruenerwald in Holt County near the Atchison-Holt County line, had a good show of oil in the Viola lime at 2,944 feet. This was the first oil discovery in Missouri since 1953.

REVIEW BY COUNTIES

Mineral production was reported in 107 of the 114 counties; 20 counties reported production valued at $1 million or more. Five counties—St. Louis, St. Francois, Ste. Genevieve, Cape Girardeau, and Jackson—contributed 59 percent of the total mineral-production value. No output was reported in Carroll, Chariton, Holt, Mississippi, New Madrid, Scotland, and Webster Counties.

Adair.—Billy Creek Coal Co., Inc., and Blacksmith Coal Co., Inc., mined coal underground. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural uses by Bailey Limestone Quarry.

Andrew.—Limestone was quarried and crushed for use as riprap by the U.S. Army Corps of Engineers and George W. Kerford Quarry.

TABLE 19.—Value of mineral production in Missouri, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Adair	$343,227	$293,787	Coal, stone.
Andrew	66,393	14,123	Stone.
Atchison	(2)	(2)	Petroleum.
Audrain	1,248,737	1,056,524	Clays, stone.
Barry	(2)	(2)	Stone, sand and gravel.
Barton	(2)	(2)	Coal, asphaltic sandstone.
Bates	134,652	127,788	Stone, coal, sand and gravel.
Benton	16,222	14,728	Sand and gravel.
Bollinger	(2)	(2)	Do.
Boone	1,126,120	840,994	Stone, sand and gravel, clays.
Buchanan	339,880	323,516	Sand and gravel, stone, clays.
Butler	20,661	22,825	Sand and gravel, clays.
Caldwell	208,532	318,239	Stone.
Callaway	1,508,862	2,001,267	Clays, coal, stone, sand and gravel.
Camden	(2)	(2)	Sand and gravel.
Cape Girardeau	9,992,819	12,256,145	Cement, stone, sand and gravel, clays.
Carroll	(2)	----------	
Carter	(2)	(2)	Sand and gravel.
Cass	246,339	370,789	Stone, clays.
Cedar	(2)	(2)	Stone.
Christian	19,496	13,600	Stone, sand and gravel.
Clark	305,418	358,066	Stone, coal.
Clay	980,343	1,265,759	Stone.
Clinton	183,009	133,929	Do.
Cole	212,744	243,268	Sand and gravel, stone.
Cooper	243,227	275,185	Stone, sand and gravel.

See footnotes at end of table.

TABLE 19.—Value of mineral production in Missouri, by counties[1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Crawford	*26,408	$135,795	Clays, stone, sand and gravel.
Dade	193,328	211,000	Stone, coal.
Dallas	(2)	(2)	Sand and gravel.
Daviess	(2)	(2)	Sand and gravel, stone.
De Kalb	172,499	132,748	Stone.
Dent	(2)	(2)	Sand and gravel.
Douglas	(2)	158,480	Stone, sand and gravel.
Dunklin	(2)	(2)	Sand and gravel.
Franklin	742,139	1,058,340	Sand and gravel, stone, clays.
Gasconade	1,952,783	2,116,023	Clays, stone, sand and gravel.
Gentry	(2)	(2)	Stone, sand and gravel.
Greene	3,185,094	3,072,660	Lime, stone, sand and gravel.
Grundy	(2)	(2)	Stone.
Harrison	190,177	298,554	Stone, coal, sand and gravel.
Henry	5,166,469	5,438,233	Coal, stone.
Hickory	20,226	(2)	Stone.
Holt	547,570	----------	
Howard	187,571	199,237	Stone, sand and gravel.
Howell	504,604	361,917	Iron ore, sand and gravel.
Iron	301,513	322,781	Stone, sand and gravel.
Jackson	9,772,126	11,126,180	Cement, stone, sand and gravel, clays.
Jasper	2,104,162	2,240,098	Stone, sand and gravel, gem stones.
Jefferson	1,257,016	1,772,827	Sand and gravel, stone, barite.
Johnson	170,450	307,524	Stone.
Knox	(2)	(2)	Do.
Laclede	37,453	(2)	Sand and gravel, stone.
Lafayette	327,905	496,413	Stone, sand and gravel, coal.
Lawrence	4,449	10,400	Sand and gravel, stone.
Lewis	(2)	(2)	Stone, sand and gravel.
Lincoln	141,443	124,888	Stone, sand and gravel, clays.
Linn	(2)	(2)	Stone, coal.
Livingston	406,048	305,791	Stone, sand and gravel, clays.
Macon	(2)	(2)	Coal, stone.
Madison	4,158,310	3,423,493	Cobalt, nickel, lead, copper, stone, silver, sand and gravel.
Maries	464,227	466,507	Clays, stone, sand and gravel.
Marion	(2)	(2)	Stone, lime.
McDonald	(2)	(2)	Sand and gravel.
Mercer	(2)	(2)	Stone.
Miller	51,591	68,240	Stone, sand and gravel.
Moniteau	51,600	61,000	Do.
Monroe	280,497	256,403	Clays, stone, sand and gravel.
Montgomery	758,417	689,013	Do.
Morgan	31,456	40,928	Sand and gravel, stone.
Newton	438,477	434,280	Lime, stone.
Nodaway	170,500	168,532	Stone, sand and gravel.
Oregon	149,370	183,587	Iron ore, stone, sand and gravel.
Osage	325,640	270,185	Clays, sand and gravel.
Ozark	14,327	(2)	Iron ore, sand and gravel.
Pemiscot	267,450	327,667	Sand and gravel.
Perry	(2)	(2)	Sand and gravel, stone.
Pettis	(2)	(2)	Stone, sand and gravel.
Phelps	129,814	213,352	Clays, stone, sand and gravel.
Pike	196,507	454,091	Stone, sand and gravel.
Platte	157,316	202,801	Stone, clays.
Polk	17,800	18,850	Sand and gravel.
Pulaski	(2)	62,015	Do.
Putnam	761,796	433,319	Coal.
Ralls	5,875,221	6,949,143	Cement, stone, coal, sand and gravel.
Randolph	1,605,234	2,880,130	Coal, stone.
Ray	483,920	328,608	Stone.
Reynolds	95,703	(2)	Sand and gravel.
Ripley	(2)	54,377	Sand and gravel, iron ore.
St. Charles	956,350	1,124,759	Stone, sand and gravel.
St. Clair	1,030,776	1,311,591	Coal, stone.
St. Francois	26,968,208	25,461,065	Lead, iron ore, lime, stone, copper, silver.
Ste. Genevieve	11,737,588	13,411,804	Lime, stone, sand and gravel.
St. Louis	27,879,472	30,712,897	Cement, stone, sand and gravel, clays, petroleum.
Saline	540,878	487,987	Stone.
Schuyler	----------	50,000	Coal.
Scott	3,100	(2)	Sand and gravel.
Shannon	349,300	533,500	Iron ore, stone, sand and gravel.
Shelby	(2)	(2)	Stone.
Stoddard	164,715	202,474	Sand and gravel.
Stone	(2)	(2)	Stone, sand and gravel.
Sullivan	94,113	(2)	Stone.
Taney	(2)	(2)	Stone, sand and gravel.

See footnotes at end of table.

TABLE 19.—Value of mineral production in Missouri, by counties [1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Texas	$31, 518	$150, 879	Stone, sand and gravel.
Vernon	413, 305	450, 966	Coal, stone, sand and gravel.
Warren	197, 052	353, 172	Clays, stone, sand and gravel.
Washington	5, 833, 299	7, 299, 826	Barite, lead, sand and gravel, zinc, stone.
Wayne	233, 242	370, 199	Stone, iron ore, sand and gravel.
Webster	(2)	-----------	
Worth	(2)	(2)	Stone.
Wright	24, 547	116, 575	Stone, sand and gravel.
Undistributed	6, 569, 626	7, 164, 596	
Total	[3] 144, 120, 000	157, 009, 000	

[1] Counties not listed because no production was reported in 1958 or 1959: Chariton, Mississippi, New Madrid, and Scotland.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Revised figure.

Atchison.—Petroleum was recovered near Tarkio.

Audrain.—The county ranked second in State clay production for the fifth consecutive year. Fire clay for refractories was mined by A. P. Green Fire Brick Co.; Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp.; Walsh Refractories Corp.; Wellsville Fire Brick Co.; North American Refractories Co.; and Refractories Division, H. K. Porter Co., Inc. Molino Lime Co. produced crushed limestone for concrete aggregate, roadstone, and agricultural stone.

Barry.—Douthitt Lime Co. produced crushed limestone. Missouri State Highway Department contracted for paving gravel.

Barton.—Coal was strip mined by Clemens Coal Co. and Jones Coal Co. Asphaltic sandstone for use on roads was produced by Bar-Co Roc, Inc.

Bates.—Alvis Limestone & Concrete Co. and Frank Underwood quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Mullies Coal Co. strip-mined coal. Clyde S. Miller produced building gravel locally.

Benton.—Gravel for paving was obtained from local deposits by J. C. Orender.

Bollinger.—Mayfield Sand & Gravel Co. produced paving gravel.

Boone.—N. R. Garrett, Adrian Materials Co., Boone Quarries, Inc., Central Stone Co., and U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Columbia Sand & Towing Co. produced building and paving sand and Columbia Special Road District produced paving gravel. Shale and fire clay were mined and used by Columbia Brick & Tile Co. to manufacture heavy clay products.

Buchanan.—Building, paving, and railroad ballast sand were produced by Pioneer Sand Co. Everett Quarries, Inc., L. S. Stafford, and U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, agstone, and riprap. Moorhead Brick & Tile Co. mined shale for common building brick and tile.

Butler.—Sand and gravel was obtained by Kittredge Gravel Co., Grobe & Sons, and Missouri State Highway Department for building, paving, and other uses. Ozark Development Co. mined clay for pottery and stoneware.

Caldwell.—Farmers Rock & Lime Co., Kingston Stone Co., and Everett Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, riprap, and agstone.

Callaway.—Callaway County ranked third in State clay production and fourth in State coal output. Fire clay for refractories was mined by Harbison-Walker Refractories Co., Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp., Clayton & Crawson, Walsh Refractories Corp., Refractories Division, H. K. Porter Co., Inc., and A. P. Green Fire Brick Co. Coal was strip mined by Mariott-Reed Coal Co. Auxvasse Stone & Gravel Co., Sulgrove Mining & Quarry Co., and Callaway Rock Quarry produced crushed limestone for concrete aggregate, roadstone, agstone, and railroad ballast. Callaway County Highway Department contracted for paving gravel. Standard Oil Co. (Ind.) announced plans to construct a marine terminal on the Missouri River near Jefferson City, scheduled for completion in 1960.

Camden.—Missouri State Highway Department contracted for paving gravel.

Cape Girardeau.—The county ranked fourth in value of mineral production. Marquette Cement Manufacturing Co. quarried clay and limestone for portland and masonry cement. Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by The Federal Materials Co., Inc., Farmers Limestone Co., and Jackson Limestone Quarry. Cape Girardeau Sand Co., Inc., produced building and paving sand; Missouri State Highway Department contracted for paving gravel. Kasten Bros. Brick Co. and Ceramo Co. mined common red clay for brick, pottery, and stoneware.

Carter.—Missouri State Highway Department contracted for paving gravel.

Cass.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Deitz Hill Development Co., Hackler & Limpus Quarry, Emmet Brosnahan Rock Co., Marino & Hoover Quarry, and S & W Quarries. United Brick & Tile Co. mined miscellaneous clay for brick and tile manufacture.

Cedar.—Alvis Limestone & Concrete Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Christian.—Limestone was quarried and crushed by Joe Howard for concrete aggregate, roadstone, and soil conditioner. Missouri State Highway Department contracted for paving gravel.

Clark.—Baker Quarry Co. and Brooks Quarry Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Hamlin Bros. Coal Co. strip-mined coal.

Clay.—Clay County ranked sixth in value of stone production. Crushed limestone was used mainly for concrete aggregate, roadstone, and riprap. Producers included Midwest Precote Co., J. H. Oldham Stone Co., Kansas City Quarries Co., Everett Quarries, Inc., and Clay County Highway Department.

Clinton.—Everett Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone, and riprap.

Cole.—Leonard Barnhart, Jefferson City Sand Co., Thompson Sand Co., and Cole County Highway Department obtained sand along the Osage and Missouri Rivers, used mainly for building and paving. U.S. Army Corps of Engineers produced crushed limestone for use as riprap.

Cooper.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Hall & Riley Quarries & Construction Co. and Castle Bros. Quarry Co. Missouri River Sand & Gravel Co. produced building sand and paving gravel.

Crawford.—Fire clay was mined for use in refractories by A. P. Green Fire Brick Co., Refractories Division, H. K. Porter Co., Inc., and Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp. Domenic Ramoni produced crushed limestone for use as a soil conditioner. Missouri State Highway Department contracted for paving gravel.

Dade.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Lockwood Rock Products. Coal was strip mined by Tyler & Claypool Coal Co.

Dallas.—Missouri State Highway Department contracted for paving gravel.

Daviess.—Snyder Quarries, Inc., produced crushed limestone and gravel. Limestone was used as a soil conditioner and gravel for paving. Bethany Falls Transit Mixed Concrete Co. obtained sand and gravel for building, paving, fill, and other uses.

De Kalb.—Everett Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, agricultural stone and riprap.

Dent.—Missouri State Highway Department contracted for and mined paving gravel.

Douglas.—Missouri State Highway Department contracted for limestone for use on roads. Welton & Gray Gravel Co. obtained paving gravel from local deposits.

Dunklin.—Paving sand and gravel was produced by Wilkey & Lankford, Inc.

Franklin.—The county ranked third in the State in value of sand and gravel produced. Producers included Pacific Pebbles, Inc., St. Louis Material & Supply Co., Meramec Sand & Gravel Co., Washington Sand Co., Clifford Dewert, and Missouri State Highway Department. Principal uses were for building and paving; a small quantity was used for grinding and polishing. Limestone and dolomite were quarried and crushed for concrete aggregate, roadstone, agstone, and riprap. Leading producers were Oliver L. Taetz Co., Inc., George Dawson, and Edwin Bebermeyer. Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp., A. P. Green Fire Brick Co., General Refractories Co., and Refractories Division, H. K. Porter Co., Inc., mined fire clay for use in refractories.

Gasconade.—The county continued to lead the State in clay production. Eight refractories-manufacturing companies mined burley, flint, and diaspore fire clays valued at nearly $2.1 million for use in refractories. Fire clay for chemical uses was mined by General Chemical Division of Allied Chemical Corp. Crushed limestone was produced by Oliver L. Taetz Co., Inc., for concrete aggregate and roadstone, and by U.S. Army Corps of Engineers for riprap.

Missouri State Highway Department contracted for paving gravel.

Gentry.—Crushed limestone for concrete aggregate, roadstone, and agricultural stone, and sand and gravel for paving was produced by Albany Gravel Co., Inc.

Greene.—The county ranked third and fifth in the State in value of lime and stone production, respectively. Ash Grove Lime & Portland Cement Co. quarried limestone at its Galloway and Springfield quarries for use in lime and for concrete aggregate, roadstone, and soil conditioner. Griesemer Stone Co., Greystone Quarry Co., Concrete Co. of Springfield, and Floyd Rose & Son also produced crushed limestone. Dimension marble was prepared by Carthage Marble Co. at its quarry. Missouri State Highway Department contracted for paving gravel.

Grundy.—Limestone for concrete aggregate, roadstone, agstone, and riprap was quarried and crushed by Jay Wilcox Limestone Quarry Co. and E. E. Trenary.

Harrison.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by L. W. Hayes, Inc., and Davis-Snyder Quarries, Inc. New Black Diamond Coal Co. mined coal underground. Sugar Creek Township contracted for paving gravel.

Henry.—The county continued to lead the State in coal production; nine strip mines each produced more than 1,000 tons. Coal was mined by Peabody Coal Co., W & W Coal Co., Inc., Redding Coal Co., Bud Jones Coal Co., Clary Coal Co., Big-Hat Coal Co., and A. G. Pence Coal Co. Limestone was crushed for concrete aggregate, roadstone, and agstone by Williams Rock Co., Davis Rock Co., and O. A. Knisely.

Hickory.—Crushed limestone for soil conditioning was produced by Roy Worthington.

Holt.—A wildcat well, No. 1 Currie, proved oil productive at a depth of 2,944 feet. The well was drilled near Corning by William Gruenerwald.

Howard.—Crushed limestone was produced for concrete aggregate and roadstone by Glasgow Quarries and for riprap by U.S. Army Corps of Engineers. Glasgow Sand Co. obtained paving sand from local deposits.

Howell.—The county ranked third in the State in iron ore production. Iron ore was mined by Shook & Fletcher Supply Co., Four Mining Co., and Koshkonong Mining Co. Missouri State Highway Department produced paving gravel.

Iron.—Heyward Granite Co. produced crushed and dimension granite in Iron County. Duncan Bros., Inc., quarried and crushed dolomite for agstone. Missouri State Highway Department contracted for paving gravel. Construction of the town site and lead mill at the Viburnum lead mine of St. Joseph Lead Co. neared completion.

Jackson.—In value of production in the State, the county ranked second in stone, third in cement, and fifth in sand and gravel and total minerals. Limestone was crushed by nine commercial producers and one noncommercial for concrete aggregate, roadstone, riprap, and agriculture. Leading producers were Beyer Crushed Rock Co., Stewart Sand & Material Co., Union Construction Co., Centropolis Crusher Co., and Harris Crushed Rock Co. Dimension limestone was prepared by Gerald Hodgins Quarry, George & Clark Stone Contractors, and Strongs Quarry. Missouri Portland Cement Co. quarried shale and limestone near Independence for manufacturing portland and masonry cement. Building and paving sand were produced by Stewart Sand & Material Co. and Kansas City Quarries Co. Miscellaneous clay for heavy clay products was mined by United Brick & Tile Co. Heptene concentrate and sodium cresylate were produced from petroleum fractions by Standard Oil Co. (Ind.) at its Sugar Creek petrochemical plant. Vermiculite from Montana was exfoliated by The Zonolite Co.

Jasper.—The county ranked fourth in value of stone and seventh in value of sand and gravel. Dimension marble for rough building, dressed building, and dressed monumental stone was quarried by Carthage Marble Corp; the company also produced crushed stone. Independent Gravel Co. and Carthage Crushed Limestone Co. produced crushed limestone for building, paving, and other uses. Miscellaneous stone (chats) was produced by American Zinc, Lead and Smelting Co., Independent Gravel Co., and the Missouri State Highway Department. Independent Gravel Co. produced grinding and polishing sand, blast sand, railroad ballast gravel, and building and paving gravel.

Jefferson.—The county continued to rank second in the State in value of sand and gravel produced. Pittsburgh Plate Glass Co., Aubuchon Silica Mining Division of Portage-Manley Sand Co., and Masters Bros. Silica Sand Co. quarried high-purity silica sand for use in plate glass and for molding, grinding and polishing, and blast sand. Building and paving sand and gravel were produced by Monarch Building Materials Corp., Ficken Material Co., Jefferson County Highway Department, and Missouri State Highway Department. Leading producers of crushed limestone were Vigus Quarries, Inc., and Bussen Quarries, Inc. Dimension limestone was prepared by Paul H. Guidicy. Ronald E. Wood, Sr. mined barite near Valles Mines. Armour Agricultural Chemical Co., Nitrogen Division, (formerly Mississippi River Chemical Co.) produced ammonia, ammonium nitrate, and ammonia solutions at Crystal City. Polystyrene was produced from styrene by Dow Chemical Co. at its petrochemical plant near Pevely. Mallinckrodt Nuclear Corp. operated its nuclear fuel production center at Hematite.

Johnson.—J. A. Tobin Construction Co., Dietz Hill Development Co., and Marr Bros. quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Knox.—Limestone was quarried and crushed by Knox County Stone Co., Inc., and McSorley Lime Co. for concrete aggregate, roadstone, and agricultural stone.

Laclede.—Missouri State Highway Department produced paving gravel. Limestone was quarried and crushed for soil conditioner by Wissbaum Quarry.

Lafayette.—Red Stone Co. and Deitz Hill Development Co. produced crushed limestone for riprap, concrete aggregate, and roadstone. Sand was dredged for building and paving purposes by Lexington Sand & Gravel Co., Glasgow Sand Co., and Raymond Driver. Earl Ashford Coal Co., F. W. Goodloe Coal Co., and Hughes Coal Mining Co. mined coal underground.

Lawrence.—Missouri State Highway Department contracted for paving gravel. Dressed dimension limestone was produced by E. L. Britain.

Lewis.—The county ranked sixth in the State in value of sand and gravel production for the second consecutive year. Building and paving sand and gravel was obtained near LaGrange by Missouri Gravel Co. Limestone was quarried and crushed for concrete aggregate, roadstone, and soil conditioner by Missouri Gravel Co. and Hamill Lime Co.

Lincoln.—Columbia Quarry Co., Watson Quarry, and Gessman Quarry quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Missouri State Highway Department contracted for paving gravel. Harbison-Walker Refractories Co. mined fire clay for refractories.

Linn.—Bailey Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Coal was strip mined by Sayre Coal Co.

Livingston.—Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by Cooper Contracting Co., Fred McVey, and Farmers Rock & Lime Co. Building, paving, and railroad-ballast sand was obtained locally by Cooley Gravel Co. Miscellaneous clay for use in brick and tile was mined by Midland Brick & Tile Co.

Macon.—Peabody Coal Co. strip-mined coal. Trager Quarries, Inc., quarried and crushed limestone for concrete aggregate and roadstone.

Madison.—National Lead Co. mined ores containing lead, copper, silver, cobalt, nickel, and iron at its Madison mine near Fredericktown. The company recovered cobalt and nickel from iron rejects of the lead-copper circuit of its Madison mill at the refinery near Fredericktown. Guidicy Marble Terrazzo & Tile Co. crushed stone for use as terrazzo. Missouri State Highway Department contracted for paving gravel.

Maries.—The county ranked third in the State in value of clay production. Diaspore, burley, and fire clays were mined by A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp., Refractories Division, H. K. Porter Co., Inc., Wallace Bros., and Dillon Bros. Virgil Smith produced crushed limestone for concrete aggregate, roadstone, and agstone. Missouri State Highway Department contracted for paving gravel.

Marion.—Quicklime and hydrated lime were produced by Marblehead Lime Co. from limestone quarried near Hannibal. S. D. Fessenden & Sons and Marblehead Lime Co. produced crushed limestone for mineral food, asphalt filler, soil conditioner, concrete aggregate, and roadstone.

McDonald.—Missouri State Highway Department contracted for paving gravel.

Mercer.—Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by Twin State Quarries, Inc., and Wilcox Quarries.

Miller.—Eldon Quarry Co. produced crushed limestone for concrete aggregate, roadstone, and agricultural stone. C. W. Roweth Co. and Missouri State Highway Department obtained paving gravel locally.

Moniteau.—Limestone was quarried and crushed for concrete aggregate, roadstone, and soil conditioner by Moniteau County Agricultural Association, Inc. Missouri State Highway Department contracted for paving gravel.

Monroe.—Fire clay for use in horizontal zinc retorts and condensers was mined by Gilliam Mining Co., Bethlehem Co., and Fluetsch Bros. Walsh Refractories Corp. mined fire clay for refractories. Hamilton Lime Co. and Central Stone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Paving gravel was obtained by Wilkerson Bros. and Monroe County Highway Department.

Montgomery.—The county ranked fourth in the State in value of clay production. Fire clay for refractories was mined by six companies. Crushed limestone was produced for concrete aggregate, roadstone, and agstone by McClain Lime Quarry and for riprap by U.S. Army Corps of Engineers. Building and paving sand was produced by Two Rivers Sand & Gravel Co. Missouri State Highway Department contracted for paving gravel.

Morgan.—Missouri State Highway Department contracted for paving gravel. Crushed limestone for use as a soil conditioner was produced by Morgan County Lime Crusher.

Newton.—Southwest Lime Co. produced quicklime from limestone quarried locally; crushed and dimension limestone also was produced. Missouri State Highway Department obtained crushed limestone and crushed miscellaneous stone (chats) in Newton County. Tripoli for polishing and buffing compounds was processed at Seneca by the American Tripoli Division of The Carborundum Co. from ore mined in Ottawa County, Okla.

Nodaway.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agriculture by Gendler Stone Products Co. Sand and gravel used mainly for building and paving was dredged by Earl Wilson Sand Co.

Oregon.—The county ranked fourth in value of iron ore production. Brown iron ore was mined by Howard Construction Co., Plateau Iron Ore Corp., Wade Miller Mining Co., and Midwest Mining Co. O. O. Mainprize quarried and crushed limestone for concrete aggregate, roadstone, and agricultural stone. Missouri State Highway Department produced paving gravel.

Osage.—Osage County ranked fifth in the State in value of clays produced. Diaspore, burley, and other fire clays were mined by A. P. Green Fire Brick Co.; Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp., North American Refractories Co., and Walsh Refractories Corp., for manufacturing refractories. Paving gravel was produced by Osage County Highway Department, Missouri State Highway Department, and Osage Township.

Ozark.—E. E. Carroll & E. H. Carroll mined brown iron ore. Ozark County Highway Department obtained paving gravel from local deposits.

Pemiscot.—Taylor Sand & Gravel Co. produced building and paving sand and gravel from local deposits.

Perry.—Gibbar Bros. produced crushed limestone for concrete aggregate, roadstone, and agstone and sand for paving. Missouri State Highway Department contracted for paving gravel.

Pettis.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by W. J. Menefee Construction Co. and Howard Construction Co.; Missouri State Highway Department contracted for paving gravel.

Phelps.—Fire clay for refractories was mined by A. P. Green Fire Brick Co., Refractories Division, H. K. Porter Co., Inc., and Dillon Bros. Limestone was quarried and crushed by Bray Construction Co. and Jessie Nivens. Building sand and gravel, fill gravel, and pea gravel were produced by Grisham Sand & Gravel Co. Missouri State Highway Department contracted for paving gravel.

Pike.—Hamill Lime Co., Magnesium Mining Co., and Galloway Limestone Co. quarried and crushed limestone for concrete aggregate, roadstone, and agstone. Goodman Sand & Gravel Co. and Missouri State Highway Department obtained paving gravel. Methanol, formaldehyde, pentaerythritol, and ammonia were manufactured using natural gas as raw material by Hercules Powder Co. at its petrochemical plant.

Platte.—Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Midwest Pre Cote Co., Everett Quarries, Inc., and U.S. Army Corps of Engineers. Miscellaneous clay for manufacturing lightweight aggregate was mined by Carter-Waters Corp.

Polk.—Missouri State Highway Department contracted for paving gravel. H. F. Butcher obtained building and paving gravel from deposits near Humansville.

Pulaski.—Building sand and gravel and fill gravel were produced by J. H. Walser Construction Co. near Waynesville. Missouri State Highway Department contracted for paving gravel.

Putnam.—Coal was mined underground by Clark Coal Co. and Williams Coal Co. and strip mined by Kirksville Coal Co.

Ralls.—The county ranked fourth in value of cement production. Universal Atlas Cement Co. produced portland and masonry cement at its plant near Ilasco. Limestone and shale for cement were obtained near the plant. Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Central Stone Co. Couch Coal Co. strip-mined coal. Edward B. Cooper obtained paving gravel locally.

Randolph.—The county ranked second in the State in value of coal output. D. L. Bradley Coal Co., Inc., Moberly Coal Co., Inc., Fately Coal Co., and Nejedly Coal Co. mined coal underground; coal was strip mined by Peabody Coal Co. and A & O Quarry & Construction Co. N. J. Cooksey Co., Ralph Potter Quarry Co., and the Moberly Special Road District quarried and crushed limestone for concrete aggregate, roadstone, and agstone.

Ray.—Steva Stone Co., Orrick Stone Co., Missouri State Highway Department, and U.S. Army Corps of Engineers quarried and crushed limestone for concrete aggregate, roadstone, riprap, and agstone.

Reynolds.—Missouri State Highway Department obtained paving gravel from local deposits.

Ripley.—Wright Gravel Co. produced building and paving sand and gravel. Missouri State Highway Department contracted for paving gravel. Brown iron ore was mined by Ripley County Mining Co.

St. Charles.—St. Charles County ranked fourth in the State in value of sand and gravel production. Glass, molding, ferrosilicon, and other industrial sands were produced by Tavern Rock Sand Co. Missouri State Highway Department contracted for paving gravel. Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by St. Charles Quarry Co., O'Fallon Quarry & Supply Co., Joerling Bros. Quarry, Schiermeier Limestone Co., and U.S. Army Corps of Engineers. Monsanto Chemical Co. began construction of a plant in St. Charles County to manufacture ultrapure silicon metal to be used in making transistors and rectifiers.

St. Clair.—The county ranked third in the State in value of coal production. P & M Coal Mining Co. and Osage Coal Co. strip-mined coal. Limestone was quarried and crushed by Alvis Limestone & Concrete Co. and Hunt Limestone Co.

St. Francois.—The county led Missouri in value of lead, iron ore, and silver, and ranked second in value of copper, lime, and total mineral production. Hematite iron ore was mined at Iron Mountain by Ozark Ore Co. St. Joseph Lead Co. mined and milled lead ore that yielded copper and silver as byproducts. Chats from lead and iron ore milling was used mainly for concrete aggregate, roadstone, and railroad ballast. Producers included St. Joseph Lead Co. and Trap Rock Material & Engineering Co. Valley Dolomite Corp. produced dead-burned dolomite for refractory uses; crushed dolomite was used as fertilizer filler, refractory material, concrete aggregate, roadstone and agstone. St. Joseph Lead Co. quarried dolomite for agricultural and fluxing purposes.

Ste. Genevieve.—The county led the State in lime production and ranked third in stone output and total mineral production. Mississippi Lime Co. quarried and crushed limestone used to produce quick and hydrated limes at its plant near Ste. Genevieve. Lime was used for chemical, industrial, and building purposes. The company sold limestone for glass, whiting, asphalt filler, coal mine rock dust, poultry grit, chemicals, agstone, and various other purposes. Crushed limestone also was produced by DeLore Division of National Lead Co., Cliffdale Quarry & Manufacturing Co., and Ste. Genevieve Building Stone Co. Building and paving sand and gravel were produced by Bauman Bros. and the Missouri State Highway Department.

St. Louis.—The county led the State in cement, stone, and sand and gravel production and in value of total mineral production. Portland and masonry cements were manufactured at Prospect Hill by

Missouri Portland Cement Co., and at Lemay by Alpha Portland Cement Co. Leading crushed limestone producers were Vigus Quarries, Inc., West Lake Quarry & Material Co., Riverview Stone & Material Co., and Rock Hill Quarries Co. West Lake Quarry & Material Co. prepared dimension limestone. Sand and gravel for construction purposes, unground industrial sands, and ground sands were produced. Leading producers, by value, were Winter Bros. Material Co., Inc., Pioneer Silica Products Co., Missouri Aggregates, Inc., Meramec Sand & Gravel Co., and St. Charles Sand Co. Shale and plastic fire clay were mined for heavy clay products and refractories. Walsh Refractories Corp. completed an expansion and improvement program costing more than $1.5 million at its St. Louis plant. Hydraulic Press Brick Co. began construction of additional facilities to produce a new line of shale and fire clay face brick. Barite was ground by the DeLore Division of National Lead Co. Titanium pigments were produced by the Titanium Division of National Lead Co. The river service bulk plant for Gulf Oil Co. was completed. Monsanto Chemical Co. manufactured calcium phosphate; capacity for the manufacture of bisphenol, maleic anhydride, and fumaric acid was increased. The company started construction of a $10-million-centralized-research center at the general offices. Zonolite Co., exfoliated vermiculite, shipped from Western States, at its plant. Perlite was expanded at a plant in St. Louis from crude perlite mined in Western States. A small quantity of petroleum was recovered.

Saline.—Limestone was quarried and crushed for concrete aggregate, roadstone, agricultural stone, and riprap by Howard Construction Co., Hall & Riley Quarries & Construction Co., George W. Kerford Quarry Co., Gilliam Rock, Inc., and Scott Quarries.

Schuyler.—Husted Bros. Coal Co. strip-mined coal in Schuyler County.

Scott.—Sand for construction purposes was obtained by Sikeston Concrete Products Co., Inc., and the Missouri State Highway Department.

Shannon.—The county ranked second in the State in iron ore production. Shook & Fletcher Supply Co. mined brown iron ore. Crider Bros. quarried and crushed limestone for use as a soil conditioner. Dimension sandstone was produced by Ozark Stone Products, Inc., and Salem Stone Co. Missouri State Highway Department contracted for paving gravel.

Shelby.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agstone by Central Stone Co. and Turner Lime & Rock Quarry.

Stoddard.—Hill & Stuart, Inc., Brown Sand & Gravel Co., and Warren Gravel Co. produced building and paving sand and gravel.

Stone.—Limestone was quarried and crushed for concrete aggregate and roadstone by Gillioz Co., Inc., and U.S. Army Corps of Engineers. Missouri State Highway Department contracted for paving gravel.

Sullivan.—Partin Lime & Rock Co. and Twin State Quarries, Inc., quarried and crushed limestone for concrete aggregate, roadstone, and agriculture.

Taney.—Trager Quarries, Inc., quarried and crushed limestone for concrete aggregate and roadstone. Missouri State Highway Department contracted for paving gravel.

Texas.—Long Bros. and Earl Duke produced crushed limestone for use as a soil conditioner. Missouri State Highway Department obtained crushed limestone and gravel for use on roads.

Vernon.—M. L. Schooley Coal & Construction Co., Ellis Coal Co., Thornhill Coal Co., and K & M Coal Co. produced coal from strip mines. Limestone was quarried and crushed for concrete aggregate, roadstone, agstone, and riprap by Trager Quarries, Inc., R. E. Jones, and Alvis Limestone & Concrete Co. Dressed dimension sandstone was produced by Missouri State Highway Department contracted Missouri Native Stone Co. for paving sand.

Warren.—Fire clay for refractories was mined by Harbison-Walker Refractories Co., Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Corp., and Walsh Refractories Corp. Sprick Quarry produced crushed limestone for concrete aggregate, roadstone, and agricultural purposes. U.S. Army Corps of Engineers obtained crushed limestone for riprap. Warren County Department of Roads and Missouri State Highway Department obtained gravel for paving.

Washington.—The county ranked first in the State in barite and zinc production and second in lead production. Barite production was reported from 16 operations by 12 companies. Leading producers were Magnet Cove Barium Corp., Milwhite Mud Sales Co., Midwest Mining Co., and Baroid Division of National Lead Co. St. Joseph Lead Co. mined and milled lead ore containing small quantities of zinc at its Indian Creek plant. Quantities of lead were recovered in mining and washing barite. Development of the Pea Ridge iron ore deposit was continued by Meramec Mining Co. A. M. Mount Sand & Gravel Co., Midwest Mining Co., and Missouri State Highway Department produced building and paving sand and gravel and railroad ballast gravel. The Missouri State Highway Department used miscellaneous stone (tiff chat) for concrete aggregate and roadstone.

Wayne.—The county ranked fifth in iron ore production value. Brown iron ore was mined by Wayne County Mining Co. and Taskee Mining Co. Crushed limestone was produced by W. J. Mencher Construction Co. and Wm. Harris & Son Lime Co. for aggregate, roadstone, and soil conditioner. Dimension sandstone also was quarried. Keener Gravel Co., Inc., and Missouri State Highway Department obtained sand and gravel for building and paving.

Worth.—Limestone was quarried and crushed for concrete aggregate, roadstone, and agricultural stone by Grand River Limestone Co.

Wright.—Missouri State Highway Department obtained crushed limestone and gravel for use on roads. W. H. Bennett Quarries, Inc., produced crushed limestone for concrete aggregate, roadstone, and agstone.

The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Montana Bureau of Mines and Geology.

By Frank B. Fulkerson,[1] Gary A. Kingston,[1] and A. J. Kauffman, Jr.[2]

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PRODUCTION of copper, the main metal mined in Montana, dropped 27 percent in quantity and $7.2 million in value in 1959, and the production of manganese declined 59 percent in quantity and $2.5 million in value. Silver, lead, and zinc production decreased less. All these metals were mined at Butte, where production was halted after August 19 because of a strike. There also was a sharp drop in the production of fluorspar in 1959. Although the total value of mineral output for the State decreased from $176.7 million in 1958 to $167.9 million in 1959, principally because of these declines, the trend was upward for many mineral commodities. Production of crude petroleum was a record 30 million barrels valued at $77 million, which was 46 percent of the total value of output from the State mines, pits, quarries, and wells. Output of phosphate rock and talc also reached new highs. Other commodities with increased quantities in 1959 were barite, cement, miscellaneous clay, gold, gypsum, iron ore, lignite, natural gas, and uranium.

Trends and Developments.—A power company obtained a 30-year lease on coal deposits in Rosebud County and planned to construct coal-fired steam-electric generating plants. Reserves of 50 to 60 million tons of coal were available for recovery by stripping methods. The 14-year decline in production of bituminous coal and lignite in Montana was reversed in 1959, owing to greater output of lignite to supply requirements of a steam-electric generating plant in Richland County.

Research continued on the economic and technologic feasibility of using Idaho clay deposits as a source of alumina for an aluminum reduction plant at Columbia Falls. Primary aluminum production increased slightly in 1959.

An interesting development was the initial carload shipment of ferrochromium produced from chromite mined in Stillwater County and smelted in an adjacent pilot plant. The shipment was made to eastern steelmills.

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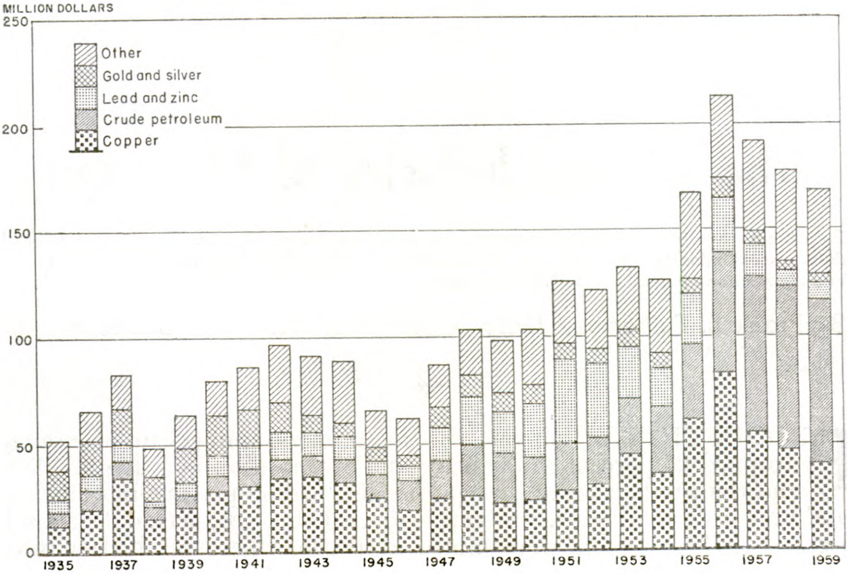

FIGURE 1.—Value of copper, crude petroleum, lead and zinc, gold and silver, and total value of mineral production in Montana, 1935–59.

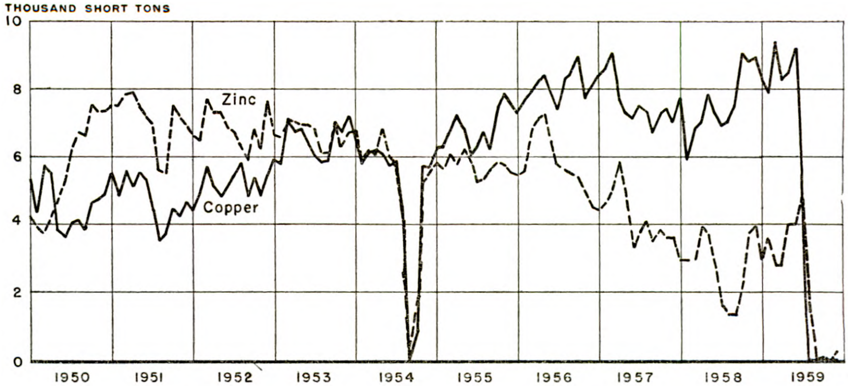

FIGURE 2.—Mine production of copper and zinc in Montana, 1950–59, by months, in terms of recoverable metals.

Iron ore mined near Stanford was shipped to eastern steel plants, and extensive holdings of iron ore near Dillon awaited development. Production of steel from iron-bearing slag accumulated during smelting operations at Anaconda was being considered.

Employment and Injuries.—Average annual employment in metal mining and primary metals processing was reduced greatly in 1959. Long strikes idled 7,000 workers at Butte mines and at Anaconda, Great Falls, and East Helena mills and smelters. The Montana Employment Service reported that these strikes, as well as work stoppages in the lumber industry and resulting secondary unemployment,

TABLE 1.—Mineral production in Montana [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromium ore and concentrate……gross weight	119,057	(2)	[3] 105,381	[3] $3,765
Clays……thousand short tons	[4] 23	[4] $19	[4] 46	[4] 48
Coal (bituminous and lignite)……do	305	1,475	345	1,478
Copper (recoverable content of ores, etc.)	90,683	47,699	65,911	40,469
Fluorspar	53,654	(2)	18,542	(2)
Gold (recoverable content of ores, etc.)……troy ounces	26,003	910	28,551	999
Iron ore (usable)……thousand long tons, gross weight	14	(2)	50	254
Lead (recoverable content of ores, etc.)	8,434	1,974	7,672	1,765
Manganese ore and concentrate (35 percent or more Mn) gross weight	53,123	4,036	21,604	1,520
Manganiferous ore and concentrate (5 to 35 percent Mn) gross weight	(2)	(2)	2,415	34
Natural gas……million cubic feet	27,989	1,903	[5] 33,000	[5] 2,300
Petroleum (crude)……thousand 42-gallon barrels	[6] 27,957	[6] 74,086	[5] 30,079	[5] 77,002
Sand and gravel……thousand short tons	13,432	12,593	10,930	12,587
Silver (recoverable content of ores, etc.) thousand troy ounces	3,631	3,286	3,420	3,096
Stone……thousand short tons	[6] 1,786	[6] 2,468	1,186	1,691
Uranium ore and concentrate (oxide content)……pounds	4,652	20	9,912	(2)
Zinc (recoverable content of ores, etc.)	33,238	6,781	27,848	6,405
Value of items that cannot be disclosed: Barite, cement, gem stones, gypsum, lime, mica, natural-gas liquids, phosphate rock, pyrites, talc, rare-earth metal concentrate, vermiculite, and values indicated by footnote 2		20,318		15,248
Total Montana [7]		[6] 176,728		167,890

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Incomplete total—excludes tonnage used for ferrochromium production.
[4] Excludes fire clay and bentonite.
[5] Preliminary figure.
[6] Revised figure.
[7] Total adjusted to eliminate duplicating value of stone.

brought industrial payrolls in September to the lowest point for that month since 1954. From 1957 to 1959 average employment in Montana metal mines dropped 40 percent. The decline in 1957 and 1958 was due to lagging demand for metal, closing of some high-cost mines, and new open-pit mines, which required fewer workers than underground mining.

TABLE 2.—Employment in mining, primary metals, and petroleum refining [1]

	Total mining	Metal mining	Nonmetallic, including coal	Petroleum and natural gas	Processing	
					Primary metals	Petroleum refining
1950–54 (average)	10,900	7,900	1,100	1,900	3,600	(2)
1955	12,000	8,400	900	2,700	4,300	1,200
1956	12,400	8,700	900	2,800	4,600	1,200
1957	11,300	7,500	900	2,900	4,900	1,200
1958	8,700	5,300	700	2,700	4,200	1,000
1959	7,500	4,500	700	2,300	3,000	900

[1] Montana State Employment Service, Montana Labor Market. Excludes proprietors and self-employed. Industry groups may vary from those in Bureau of Mines canvass.
[2] Figures not published before 1953.

TABLE 3.—Average weekly earnings, weekly hours, and hourly earnings of workers in mining, metal mining, and primary metals [1]

	1955	1956	1957	1958	1959
Mining:					
Average weekly earnings	$91. 63	$102. 77	$96. 79	$97. 42	$101. 91
Average weekly hours	40. 3	41. 7	38. 9	39. 6	40. 6
Average hourly earnings	$2. 28	$2. 47	$2. 49	$2. 46	$2. 51
Metal mining:					
Average weekly earnings	$90. 77	$103. 41	$92. 78	$93. 56	(2)
Average weekly hours	40. 3	42. 2	38. 2	38. 5	(2)
Average hourly earnings	$2. 25	$2. 45	$2. 43	$2. 43	(2)
Primary-metals processing:					
Average weekly earnings	$84. 95	$98. 89	$90. 55	$91. 57	(2)
Average weekly hours	41. 5	44. 1	39. 9	39. 3	(2)
Average hourly earnings	$2. 05	$2. 24	$2. 27	$2. 33	(2)

[1] Montana State Employment Service, Montana Labor Market. Hours and earnings data exclude administrative and salaried personnel. Average weekly and hourly earnings include overtime and other premium pay.

[2] Strike in metal-mining industry beginning Aug. 19, 1959, unsettled at yearend.

TABLE 4.—Employers, wage earners, and wages in mining [1]

Fiscal year	Average number of employers	Average number of wage earners	Wages (thousands)	Average wage level
1950–54 (average)	488	10, 729	$45, 465	$4, 237
1955	524	10, 710	49, 036	4, 578
1956	528	12, 193	65, 154	5, 344
1957	526	12, 021	65, 017	5, 409
1958	448	9, 019	48, 503	5, 378
1959	416	8, 722	46, 017	5, 276

[1] Unemployment Compensation Commission of Montana, Montana Labor Market. Industries and employment covered under unemployment insurance laws of Montana.

TABLE 5.—Injuries in the mineral industries

	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1958						
Quarries and mills [1]	287	236	541, 720	----------	2	4
Sand and gravel operations	280	140	313, 057	----------	6	19
Metal and nonmetal mines and mills	5, 971	263	12, 553, 782	9	171	14
Coal mines	279	120	267, 306	4	7	41
Total	6, 817	251	13, 675, 865	13	186	15
1959 [2]						
Quarries and mills [1]	204	244	398, 029	----------	----------	----------
Sand and gravel operations	348	142	394, 678	----------	15	38
Metal and nonmetal mines and mills	4, 581	234	8, 568, 431	4	158	19
Coal mines	224	136	243, 506	----------	5	21
Total	5, 357	224	9, 604, 644	4	178	19

[1] Includes cement- and lime-processing plants.

[2] Preliminary figures.

Total nonagricultural employment in the State dropped from 161,200 to 160,400. Contract construction employment averaged 10,800 compared with 10,900 in 1958. The slight drop in employment in construction trades was due to less employment on public-works projects. More workers were employed in residential and nonresidential construction than in 1958.

Injury statistics for the Montana mining industry included in this chapter are based on reports to the Bureau of Mines from the individual companies.

Government Programs.—The Office of Minerals Exploration (OME), U.S. Department of the Interior, provided financial assistance in exploring strategic-mineral deposits. New contracts were in effect at the Baltimore mine (copper, lead, zinc) in Jefferson County and at the Hidden Hand group (lead, zinc) in Powell County. Other active contracts included one each in Carbon County (uranium), Granite County (manganese), Jefferson County (copper), and Judith Basin County (lead, zinc).

TABLE 6.—Office of Minerals Exploration contracts active during 1959

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
CARBON					
Midland Mining Co	Sandra group	Uranium	June 3, 1957	$27,008	75
GRANITE					
Taylor-Knapp Co	True Fissure and Durango.	Manganese	Feb. 1, 1954	648,727	75
JEFFERSON					
The Baltimore Syndicate, Ltd.	Baltimore	Copper, lead, zinc	July 27, 1959	22,930	50
Mine Explorers, Inc. (formerly Uranium Corp. of America).	Dailey Copper	Copper	Oct. 18, 1957	85,172	50
JUDITH BASIN					
John Zupan	Doctor Kalloch	Lead, zinc	May 9, 1958	11,708	50
POWELL					
Howard C. Banks	Hidden Hand group	do	June 23, 1959	13,900	50

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—Primary aluminum production increased slightly (approximately 2 percent) as a result of increased output by Anaconda Aluminum Co., Columbia Falls. Output was 50,743 tons according to the annual company report to shareholders. Plant output increased from 75 to 88 percent of capacity in July with the reactivation of 30 reduction cells. This increase, which brought annual primary ingot output to 57,000 tons, was made because of improved sales outlook and industrial conditions. Negotiations between the company and the Aluminum Workers Trade Council led to a new labor contract in May, which provided a wage increase and more fringe benefits. Research continued on the economic and technologic feasibility of using

Idaho clay deposits as a source of alumina, which would relieve the company of costly transport expenses incurred by hauling from sources at considerable distance from the reduction plant. Should this be accomplished, the Anaconda Aluminum Co. operation would be integrated completely from procuring raw materials to finishing aluminum products.

The Columbia Falls reduction works continued to supply aluminum bar to Anaconda Wire & Cable Co., Great Falls, where aluminum rod and wire were drawn in an automated Swedish-built mill. Sales of these products were favorable in a highly competitive market.

Chromium.—Production was delivered almost entirely to a Federal stockpile; a small quantity was used in producing ferrochromium. Chromite was mined and milled at the American Chrome Co. Mouat mine, Stillwater County, for delivery to a Federal stockpile at Nye. Shipments of concentrate totaled 105,381 short tons, a decline of 12 percent compared with deliveries in 1958. The purchase contract with General Services Administration (GSA) was scheduled to expire December 31, 1961, or when the maximum tonnage of 900,000 short tons was reached. Approximately 200,000 tons remained to be delivered before the tonnage quota would be met. Mining operations were reduced from 6 to 5 days a week during the year. Ferrochromium was produced by the company at Nye in a pilot smelting plant, using ore concentrate from the Mouatt mine. Metal output exceeded 2,000 tons. An initial carload of ferrochromium was shipped to eastern steelmills. Goldfield Consolidated Mines Co. increased its ownership in American Chrome Co. from 66.0 to 87.5 percent during the year.

A pilot plant producing sodium bichromate for the Atomic Energy Commission (AEC) at Hanford, Wash., was operated by Mouatt Industry, Inc., Columbus, Mont. Chromium ore for the operation was obtained from stockpiled material previously mined at the Benbow mine, Stillwater County.

Copper.—An industry-wide strike reduced State production to 65,911 tons, a decline of 27 percent. Mines and metallurgical works of The Anaconda Co., one of the leading domestic copper producers, were closed from mid-August through yearend as a result of a strike called by the International Union of Mine, Mill & Smelter Workers. The length of the walkout prompted the company to indicate that some of its marginal mines (in terms of operational costs versus profit) would not be reopened when work resumed and that major projects such as the Berkeley pit would be emphasized further. It was indicated that automation would play a significant role in keeping this operation on an economically competitive basis. The economical operation of the Butte area mines was an issue in the management-union negotiations for a new labor contract. Settlement was reached late in December at Anaconda. The Berkeley pit and Kelley mine operated at high production rates before the strike; copper ore was mined in veins at the Mountain Con and Steward mines during the year.

Gold.—A substantial change was recorded in gold output; production increased nearly 10 percent, reaching 28,551 ounces. Miscellaneous shipments to The Anaconda Co. before the strike largely accounted for a rise, and the total gold recovered by Anaconda mining and smelting increased in spite of the extended closure.

Iron Ore.—Shipments went up sharply to 50,081 long tons; this was more than 3½ times the 13,583 tons shipped in 1958.

The principal shipper was Young-Montana Corp., mining a property near Stanford. Over 37,000 long tons of magnetite (63 percent iron) was shipped by rail to Duluth, Minn., where it was reloaded on a ship for delivery to eastern steel plants.

Magnetite ore (45 percent iron) shipments from the Iron Cross property of Ralls & Harris Bros. totaled nearly 11,000 tons and was used in manufacturing cement.

Minerals Engineering Co. shipped 2,000 tons of magnetite (30 percent iron) from the Carter Creek properties near Dillon to Birmingham, Ala., for testing to determine its suitability in the R–N direct-reduction process. The deposit was sold during the year to North American Utilities Corp., Calgary, Canada.

Lead.—Lead output was 7,672 tons, a 9-percent drop from the 8,434 tons produced in 1958. Production was lower owing to closure by strikes of The Anaconda Co. reduction works, where lead was recovered as a byproduct of zinc operations, and of the American Smelting and Refining Co. East Helena lead smelter. The Jack Waite mine, operated by American Smelting and Refining Co. in Sanders County, supplied a sizable percentage of State total.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals[1]

Year	Mines producing		Material sold or treated[2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950–54 (average)	172	16	4,681	30,971	$1,084	6,198	$5,610
1955	100	12	7,260	28,123	984	6,080	5,503
1956	152	7	9,536	38,121	1,334	7,386	6,685
1957	125	13	10,790	32,766	1,147	5,558	5,030
1958	125	11	10,861	26,003	910	3,631	3,286
1959	96	14	8,779	28,551	999	3,420	3,096
1862–1959	----------	----------	(3)	17,576,000	399,630	825,799	616,447

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	62,160	$32,000	19,393	$5,761	75,327	$21,855	$66,309
1955	81,542	60,830	17,028	5,074	68,588	16,873	89,265
1956	96,426	81,962	18,642	5,854	70,520	19,322	115,157
1957	91,512	55,090	13,300	3,804	50,520	11,721	76,792
1958	90,683	47,699	8,434	1,974	33,238	6,781	60,649
1959	65,911	40,469	7,672	1,765	27,848	6,405	52,734
1862–1959	7,488,000	2,419,754	910,000	141,458	2,649,000	500,013	4,077,302

[1] Includes recoverable metal content of gravel washed (placer mines), ore milled, old tailings retreated, and ore, old slag, and copper precipitates shipped to smelters during calendar year indicated. Owing to rounding, figures may not add to totals.

[2] Does not include gravel washed.

[3] Data not available.

TABLE 8.—Gold produced at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods			Total		
	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)	Number of operations	Material treated (thousand cubic yards)	Gold (troy ounces)
1950–54 (average)	4	409	1,400	[1] 12	4	68	16	413	1,468
1955	8	581	3,295	4	(²)	57	12	581	3,352
1956	5	267	1,483	2	(²)	13	7	267	1,496
1957	8	170	724	5	1	78	13	171	802
1958	7	209	1,069	4	1	19	11	210	1,088
1959	[3] 9	157	973	5	4	29	14	161	1,002

[1] Includes surface and underground (drift) placers.
[2] Less than 500.
[3] Includes 1 bucketline dredge, 1 dragline dredge, 4 hydraulic operations, and 3 nonfloating washing plants; Bureau of Mines not at liberty to publish separately.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals[1]

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
Beaverhead	13	1	355	$12	14,610	$13
Broadwater	12	3	889	31	5,579	5
Deer Lodge	1	----------	2	(²)	714	1
Granite	6	1	56	2	57,381	52
Jefferson	8	1	807	28	12,373	11
Missoula	2	----------	38	1	2,551	2
Powell	2	2	55	2	221	(²)
Silver Bow	15	1	18,615	652	3,204,038	2,900
Undistributed [3]	37	5	7,734	271	122,909	111
Total	96	14	28,551	999	3,420,376	3,096

County	Copper		Lead		Zinc		Total
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Value (thousands)
Beaverhead	14	$9	178	$41	59	$14	$89
Broadwater	2	1	32	7	3	1	45
Deer Lodge	----------	----------	----------	----------	----------	----------	1
Granite	6	4	67	15	352	81	154
Jefferson	2	1	75	17	60	14	72
Missoula	11	7	----------	----------	----------	----------	10
Powell	----------	----------	2	(²)	1	(²)	3
Silver Bow	65,810	40,407	4,456	1,025	22,459	5,166	50,149
Undistributed [3]	66	41	2,862	658	4,914	1,130	2,211
Total	65,911	40,469	7,672	1,765	27,848	6,405	52,734

[1] Owing to rounding, figures may not add to totals.
[2] Less than $500.
[3] Includes values and quantities that cannot be shown separately for Fergus, Flathead, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Park, Phillips, Ravalli, Sanders, and Toole Counties.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	19	12,296	8,221	59,011	1,100	1,700	1,500
Dry gold-silver	11	1,869	325	15,849	1,200	34,000	14,900
Dry silver	20	20,537	817	136,304	12,957	87,000	98,700
Total	50	34,702	9,363	211,164	15,257	122,700	115,100
Copper	10	8,069,191	12,917	1,638,305	125,937,235	------	1,700
Lead	18	17,557	138	45,120	107,200	4,779,100	384,100
Lead-zinc	5	1,272	59	2,435	200	81,100	49,700
Zinc and old zinc slag [2]	6	648,214	4,864	1,512,058	1,566,546	10,355,100	55,140,500
Total	39	8,736,234	17,978	3,197,918	127,611,181	15,215,300	55,576,000
Other lode material:							
Dry gold cleanup and old tailings, dry gold-silver old tailings, and dry silver old tailings [2]	4	7,597	202	10,656	2,436	------	1,000
Copper: Precipitates	------	------	------	------	4,192,826	------	------
Lead cleanup, lead-zinc cleanup, lead-zinc slag, and manganese tailings [2]	4	[3] 169	6	393	300	6,000	3,900
Total	8	7,766	208	11,049	4,195,562	6,000	4,900
Total "lode" material	96	8,778,702	27,549	3,420,131	131,822,000	15,344,000	55,696,000
Gravel (placer operations)	14	(4)	1,002	245	------	------	------
Total	110	8,778,702	28,551	3,420,376	131,822,000	15,344,000	55,696,000

[1] Figures do not necessarily add to total, because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Includes 117 tons of manganese tailings containing gold and silver.
[4] 161,460 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1959, by types of material processed and methods of recovery, in terms of recoverable metals

Types of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	29	2	------	------	------
Concentration and smelting of concentrates	18,401	3,163,381	127,523,781	12,522,000	45,860,600
Total	18,430	3,163,383	127,523,781	12,522,000	45,860,600
Direct smelting:					
Ore	8,911	241,489	80,957	1,505,000	308,300
Old tailings	127	10,731	2,336	------	------
Old slag and cleanup [1]	81	4,528	22,100	1,317,000	9,527,100
Copper precipitates	------	------	4,192,826	------	------
Total	9,119	256,748	4,298,219	2,822,000	9,835,400
Placer	1,002	245	------	------	------
Grand total	28,551	3,420,376	131,822,000	15,344,000	55,696,000

[1] Combined to avoid disclosing individual company confidential data.

Manganese.—Production of manganese ore (35 percent or more Mn) decreased 59 percent to 21,604 tons from 53,123 tons in 1958. Three companies were principal producers. The decline was attributable to reduced output at The Anaconda Co. nodulizing plant at Anaconda Reduction Works where rhodochrosite ore from the Emma mine at Butte was concentrated by flotation and nodulized. Most manganese nodules produced by The Anaconda Co. were consumed for production of ferromanganese by the company at Anaconda. Poor markets during the year, partly attributable to the geographic isolation of the plant in relation to consumers, kept the ferromanganese smelter closed during the first half of the year, and nodules were stockpiled. Production was resumed at midyear but again was stopped in August, owing to the strike.

Trout Mining Co. shipped 46 percent more battery-grade ore than in the previous year and 34 percent less manganiferous ore (less than 35 percent Mn) for metallurgical usage; production came from the Algonquin group near Philipsburg.

Taylor-Knapp Co. increased mine output from mines (Moorlight group) near Philipsburg, but operations were affected adversely during the year by completion of the Federal carlot stockpiling program for Metallurgical-grade ores. Termination of the purchase program resulted in a sizable work-force reduction by the company; however, a market reorientation improved the outlook in the last quarter, enabling the return of some workers.

Minor Metals.—Cadmium, gallium, and indium were recovered by The Anaconda Co. as byproducts of zinc-refining operations. Cadmium output in 1959 totaled 618,000 pounds compared to 1,246,000 pounds in 1958.

Silver.—The mine and smelter strike was responsible for a 6-percent drop in the State total to 3,420,376 ounces, compared with 3,630,530 ounces recovered in 1958. The Anaconda Co. zinc mines (Anselmo and Alice pit) yielded more than 1.4 million ounces of silver, 39 percent more than the yield in 1958; however, silver output declined from other mines of the company. Approximately 94 percent of the State total was mined in Silver Bow County.

Steel.—Plans were announced in September for processing iron-bearing slag (from copper smelting) at the Anconda Reduction Works to produce steel and to recover copper and zinc. The slag residue would be used in manufacturing insulation and as a lightweight aggregate. The announcement was made after negotiations were completed between Webb & Knapp, Inc., and The Anaconda Co. for the 40-million-ton slag pile, which averages approximately 33 percent iron, 0.5 percent copper, and 2 percent zinc. Strategic Materials Corp. was to build and operate the plant, using the Strategic-Udy process, on land facing the slag pile. The plant tenatively was scheduled for completion by 1962.

Thorium.—Sawyer Petroleum Co. shipped a small quantity of thorite concentrate from a property in Beaverhead County near Lemhi Pass. The ore was beneficiated at a tungsten mill near Glen, owned by Minerals Engineering Co.

Tungsten.—Minerals Engineering Co. reopened the Calvert mine (also known as the Red Button group) near Wise River in Beaverhead

National Forest. Beginning in September, ore was mined by multiple benching and stockpiled until it was hauled to a mill 50 miles away after the first of the year. Resumption of tungsten mining was the result of industry contracts obtained by the company.

Uranium.—Production of uranium rose substantially to 9,912 pounds of uranium oxide contained in 2,890 tons of ore mined by three companies in Carbon County. Lisbon Uranium Corp. was the leading producer.

Zinc.—Zinc output declined 16 percent to 27,848 tons—5,390 tons lower than output in 1958. As for many other commodities, the mine and smelter strike was responsible for the drop.

The Anaconda Co. zinc plant at the Anconda Reduction Works was closed early in August; materials formerly treated at Anaconda were diverted to company facilities at Great Falls until that plant was closed by strike several weeks later.

NONMETALS

Barite.—Production of barite increased 16 percent. Baroid Sales Division, National Lead Co., the only producer of barite in the State, mined and ground the mineral at Greenough, Missoula County. As in previous years, the bulk of the output was used as a drilling-mud constituent.

Cement.—Shipments and value of portland and masonry cement increased 10 and 8 percent, respectively. Ideal Cement Co., Montana Division, at Trident, Gallatin County, continued to be the only producer of cement in the State. The company mined limestone and sandstone and purchased gypsum and iron ore for use in cement manufacturing. Most of the cement sold (88 percent) was shipped to destinations within the State; principal out-of-State destinations were North Dakota and Wyoming.

Clays.—A large increase in the quantity of miscellaneous clay produced for making building brick and lightweight aggregate was accompanied by a sharp drop in output of fire clay and bentonite. Montana Lightweight Aggregate Co., Billings, Yellowstone County, began operation of a plant for making lightweight aggregate. Miscellaneous clay was dug in Yellowstone, Powell, Fergus, and Lewis and Clark Counties. Bentonite, mainly for use as a bonding agent in refractories, came from Carter County, and fire clay for making refractories was produced in Cascade and Deer Lodge Counties.

Treasure State Industries announced plans to construct a plant near Great Falls to expand shale for use as lightweight aggregate in prestressed and precast concrete.

Fluorspar.—Only a small quantity of crude fluorspar was mined during the year, and shipments of a high-grade product, processed mainly from stocks, dropped to 18,500 tons, compared with 53,600 tons in 1958. Cummings-Roberts, Darby, Ravalli County, was the only source. Most of the output was consumed by the steel industry.

Gypsum.—The quantity and value of crude gypsum mined increased 33 and 38 percent, respectively. Activity again was confined to Fergus County—Shoemaker mine (U.S. Gypsum Co.) and Hanover mine (Ideal Cement Co.). The bulk of the production was calcined and marketed as ground gypsum, wallboard, and lath. Uncalcined gypsum was used mainly as a cement retarder; only a small quantity was used for agriculture.

Lime.—Output and value of lime declined 33 and 26 percent, respectively, from the record output and value established in 1958. The Anaconda Co. (Deer Lodge County) produced quicklime for use at its ore concentrator and metallurgical works. Production by the company decreased because the plant was closed more than 4 months by a labor dispute. Elliston Lime Co. (Powell County) calcined limestone to quicklime and also made a small quantity of hydrated lime.

Mica.—A small quantity of hand-cobbed mica was produced from the Thumper Lode near Gallatin Gateway, Gallatin County. As in past years, the material was shipped to the Government purchase depot at Custer, S. Dak.

Phosphate Rock.—Quantity and value of marketable phosphate rock produced in Montana reached a new high, surpassing the 1958 totals by 6 and 4 percent, respectively. Operations in Beaverhead, Powell, and Silver Bow Counties contributed to the output, which was converted to elemental phosphorus, phosphoric acid, and phosphate fertilizers. Part of the phosphate rock mined was exported to British Columbia.

The new facility of The Anaconda Co. at Anaconda, Deer Lodge County, completed its first year of production. Here pelletized ammonium phosphate was made from Idaho phosphate rock.

The Bunker Hill Co., which was constructing a fertilizer plant at Kellogg, Idaho, began evaluating the Jack Pine (Trout Creek) phosphate-rock lease near Elliston, Powell County, to determine the extent and quality of the deposit.

Pyrite.—There was a 42-percent decrease in the quantity of pyrite converted to sulfuric acid by The Anaconda Co. A product high in pyrite recovered from processing Silver Bow County base-metal ores was the source material. The sulfuric acid was used at the company chemical-fertilizer plant and metallurgical works.

Sand and Gravel.—Thirty-one counties in the State contributed to a total sand and gravel output of 10.9 million tons ($12.6 million) compared with 13.4 million tons ($12.6 million) in 1958. The decrease was due mainly to curtailed activities of the Montana Highway Department. The U.S. Army Corps of Engineers used more sand and gravel at its projects throughout the State, but not enough to offset the drop in consumption by the highway department.

Distribution by use was: Road material, 79 percent; building, 15 percent; railroad ballast and miscellaneous, 6 percent. These values differed greatly from the 1958 percentages of 90, 7, and 3, respectively.

Stone.—Output of stone totaled 1.2 million tons ($1.7 million) compared with 1.8 million tons ($2.5 million) in 1958. There was a decline of 20 percent in the quantity of stone used for commercial purposes and a 60-percent decline in the quantity used by Federal, State, county, and municipal bodies. The largest decreases for noncommercial uses were recorded for basalt and limestone.

Quarries were active in 16 of the 56 counties in the State. Limestone was mined in seven counties; Gallatin and Deer Lodge Counties accounted for 85 percent of the total tonnage. Major consumption was for making cement and lime and refining sugar. Miscellaneous stone was quarried in Flathead and Cascade Counties; sandstone came from Broadwater, Stillwater, and Musselshell Counties; and granite was quarried in Missoula County.

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Uses	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Building	868	$1,262	807	$1,249
Road material	836	893	634	691
Railroad ballast	323	144	497	294
Other [1]	110	102	126	102
Total	2,136	2,400	2,064	2,335
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	100	184	822	609
Road material	11,195	10,008	8,044	9,643
Total	11,296	10,193	8,866	10,252
ALL OPERATIONS				
Building	968	1,446	1,628	1,858
Road material	12,031	10,901	8,678	10,334
Railraod ballast	323	144	497	294
Other [1]	110	102	126	102
Grand total [2]	13,432	12,593	10,930	12,587

[1] Includes sand and gravel used for miscellaneous unspecified purposes.
[2] Owing to rounding, individual items may not add to total shown.

Sulfur.—Production of high-purity elemental sulfur from refinery gases was higher than in 1958; shipments also increased. Two oil refineries near Billings, Yellowstone County, provided the raw material to the Montana Sulphur & Chemical Co.

Talc.—Quantity and value of talc mined in the State rose sharply, compared with 1958 to reach a new record. From 1957 to 1959, output of talc more than doubled, and the value increased almost fourfold. Production was reported from six mines in Madison County and one mine in Beaverhead County. About 37 percent of the production was shipped to grinding plants at Grand Island, Nebr.; Ogden, Utah; and Los Angeles, Calif. The remainder was ground by Tri-State Minerals Co. at its Barratts mill (Beaverhead County) and by American Chemet Corp. at a plant near East Helena (Lewis and Clark County).

There was a shift in the use pattern of ground talc, compared with 1958 (1958 percentages are in parentheses): Paint, 57 percent (48 percent); ceramics, 20 percent (33 percent); and miscellaneous, including textiles, paper, and rice polishing, 23 percent (19 percent).

Vermiculite.—Output of crude vermiculite by Zonolite Co. advanced 5 percent above output in 1958. The company operated an open pit near Libby, Lincoln County, which continued to be the major source of vermiculite in the Nation. As in past years, some of the output was exfoliated by a company in Great Falls, Cascade County, and the bulk shipped out of the State for expanding.

MINERAL FUELS

Coal.—There was a 40,000-ton increase in the quantity of bituminous coal and lignite mined, compared with 1958. This marked a reversal of the decline that had continued for 14 consecutive years. Greater output of lignite to supply requirements of the steam-electric generating plant of Montana-Dakota Utilities Co. at Sidney, Richland County, was the principal cause of the trend change. The tonnage of bituminous coal mined was 60,000 tons less than in 1958.

Production was furnished by 24 mines in 10 counties. Mines in Musselshell County accounted for about 84 percent of the bituminous-coal output; Carbon, Rosebud, Blaine, Cascade, and Hill County properties also contributed. Two mines near Savage, Richland County, provided the major share of the lignite output. Production also came from Sheridan, Custer, and Dawson Counties.

Montana Power Co. obtained a 30-year lease on coal deposits near Colstrip (Rosebud County) from the Northern Pacific Railway Co. The power company indicated that its future power supply was expected to come largely from coal-fired steam-electric generating plants. The Northern Pacific Railway Co. stated that 50 to 60 million tons of coal could be recovered by large-scale, low-cost stripping methods.

Petroleum and Natural Gas[3].—Crude oil production rose to a record of 30.1 million barrels ($77 million), compared with 28 million barrels ($74 million) in 1958. Petroleum again was the most valuable mineral produced and represented 46 percent of the total value of mineral output for the year. Combined production from the Pine, Cabin Creek, and Elk Basin fields represented 44 percent of the total production. Other important fields with output in excess of 1 million barrels were Poplar East, Cut Bank, Sumatra, and Stensvad.

Ten refineries processed 26.1 million barrels of crude oil; Montana wells supplied 42 percent of the total, and Wyoming furnished 58 percent. Of 325 wells drilled during the year, 157 yielded oil, 13 yielded gas, and 155 were dry. There were 10 less wells drilled than in 1958, but the same number of dry holes.

Gross withdrawals of natural gas (marketed production plus quantities used in repressuring, as well as that vented and wasted) totaled 31.7 billion cubic feet as compared with 31 billion in 1958. Production of 10.2 billion cubic feet (11.8 billion in 1958) made Cut Bank (including Reagan) the principal natural-gas-producing field. Six other fields with recovery in excess of 1 billion cubic feet (in order of output) were Cedar Creek, Bowdoin, Dry Creek, Keith Block, Utopia, and Kevin Sunburst.

The Montana Power Co. began producing natural gas from the Grand View field, Liberty County. This field was discovered in 1951 by The Anaconda Co. but the wells were shut in until a gathering system was completed.

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[3] State Oil and Gas Conservation Commission, Montana Oil and Gas Statistical Bulletins, monthly.

In November the Montana Oil & Gas Conservation Commission issued an order that required 40-acre spacing of drill holes on a statewide basis. Formerly nine wells could be drilled per 160 acres.

Water injection was begun to increase crude oil recovery at the Cat Creek field, Petroleum County; the Cabin Creek field, Fallon County; and the Pine field, extending into Fallon, Prairie, and Wibaux Counties.

Carter Oil Co. began building an asphalt emulsification unit and revamping its road-oil plant at Billings.

REVIEW BY COUNTIES

Beaverhead.—Mineral rights to the Carter Creek iron deposit, 11 miles from Dillon, were sold for $1 million and future royalties to North American Utilities Corp., Calgary, Alberta, by Minerals Engineering Co. of Grand Junction, Colo. The purchasing company and its subsidiary, West Canadian Magnetic Ores, Ltd., (controlled by Canadian, British, and French capital), were promoting a steelmill to be constructed at Burmis, Alberta. Burmis is near the Crowsnest coal area, source of bituminous coking coals. The new owners purchased 800 acres near the iron deposit as a site for a proposed mill, which would beneficiate the 25- to 30-percent acid-soluble iron ore (principally magnetite) to an approximate 60-percent iron concentrate. Anticipated mill capacity was 5,000 tons of ore a day. Concentrate would be pelletized before rail shipment to the Alberta steel plant, where the iron would be reduced to steel with Crowsnest coal. No schedule was announced for starting the proposed mining, milling, or reduction operations. A test lot of ore (2,000 tons), shipped by Minerals Engineering before the sale of the deposit, was the only ore produced from the property during the year.

The Maulden lead mine yielded 2,377 tons of ore, a 7-percent increase over the output in 1958. Twelve other lode mines and one smelter slag dump (Glendale smelter) produced the balance of gold, silver, copper, lead, and zinc ore in the county.

Security Mines Co. recovered gold and silver from 9,000 cubic yards of bench gravel worth nearly $5,000. A Kolman conveyor washer was operated at the Bannack group placer claims by the Worland (Wyo.) company.

Sawyer Petroleum Co. investigated thorium holdings in Horse Prairie, west of Armstead near Lemhi Pass. A small quantity of thorite was shipped to Glen, where it was milled in the Minerals Engineering Co. plant. The concentrate reportedly was marketed to Continental Ore Corp.

The Calvert tungsten mine was reopened in September by Minerals Engineering Co. Fifteen men were engaged in preparing the mine for planned monthly ore shipments of approximately 5,000 tons, beginning in January 1960. Ore was to be shipped to a company-owned mill at Glen for beneficiation. The concentrate would be shipped by rail directly to contracting consumers, and the middling would be trucked to facilities at Salt Lake City, Utah, for acid upgrading.

Production of phosphate rock at the Victor Chemical Works Canyon Creek mine near Melrose rose greatly. Output was shipped to the

TABLE 13.—Value of mineral production in Montana, by counties [1]

(Thousand dollars)

County	1958	1959	Minerals produced in 1959 in order of value
Beaverhead	(2)	(2)	Phosphate rock, talc, lead, zinc, silver, gold, iron ore, copper, thorium.
Big Horn	$247	$322	Petroleum, stone, sand and gravel.
Blaine	471	572	Petroleum, coal, sand and gravel.
Broadwater	130	166	Iron ore, gold, stone, sand and gravel, lead, silver, copper, zinc.
Carbon	9,217	11,499	Petroleum, stone, coal, uranium, sand and gravel.
Carter	(2)	112	Petroleum, clays.
Cascade	605	742	Sand and gravel, coal, stone, clays.
Chouteau	33	----------	
Custer	117	154	Sand and gravel, coal.
Daniels, Roosevelt [3]	11,836	10,633	Petroleum, sand and gravel.
Dawson, McCone [3]	3,309	3,604	Petroleum, sand and gravel, coal.
Deer Lodge	862	532	Lime, stone, sand and gravel, silver, clays, gold.
Fallon, Prairie, Wibaux [3]	28,682	26,745	Petroleum.
Fergus	(2)	(2)	Gypsum, clays, sand and gravel, lead, zinc, silver, gold.
Flathead	414	552	Stone, sand and gravel.
Gallatin	(2)	(2)	Cement, stone, sand and gravel, mica.
Garfield, Petroleum [3]	461	394	Petroleum.
Glacier, Pondera, Teton, Toole [3].	12,054	10,671	Petroleum, sand and gravel, stone.
Golden Valley	----------	(2)	Petroleum.
Granite	1,064	1,063	Manganese ore, zinc, silver, manganiferous ore, lead copper, gold, stone, sand and gravel.
Hill	(2)	121	Sand and gravel, coal.
Jefferson	254	132	Stone, gold, lead, zinc, silver, copper.
Judith Basin	(2)	219	Iron ore, sand and gravel.
Lake	(2)	(2)	Sand and gravel.
Lewis and Clark	1,517	(2)	Zinc, lead, sand and gravel, copper, silver, clays, gold.
Liberty	255	125	Petroleum.
Lincoln	(2)	(2)	Vermiculite, lead, zinc, silver, gold.
Madison	620	964	Talc, gold, silver, copper, zinc.
Meagher	(2)	(2)	Lead, silver, zinc, copper, gold.
Mineral	45	57	Sand and gravel, gold.
Missoula	230	195	Sand and gravel, barite, copper, stone, silver, gold.
Musselshell	2,812	2,427	Petroleum, coal, stone.
Park	142	(2)	Sand and gravel, zinc, lead, silver, gold.
Phillips	(2)	146	Sand and gravel, gold.
Powder River	(2)	----------	
Powell	(2)	(2)	Phosphate rock, lime, stone, clays, sand and gravel, gold, lead, zinc, silver.
Ravalli	(2)	(2)	Fluorspar, sand and gravel, silver, lead, zinc, gold, copper.
Richland	(2)	(2)	Coal, petroleum.
Rosebud	4,140	7,059	Petroleum, coal.
Sanders	755	(2)	Lead, zinc, copper, silver, sand and gravel, gold.
Sheridan	1,048	1,512	Petroleum, coal, sand and gravel.
Silver Bow	62,547	51,719	Copper, zinc, silver, lead, gold, manganese, phosphate rock, pyrites, sand and gravel.
Stillwater	(2)	(2)	Chromium, sand and gravel.
Treasure	(2)	(2)	Sand and gravel.
Valley	1,151	1,726	Sand and gravel, stone.
Yellowstone	1,713	1,877	Petroleum, sand and gravel, clays.
Undistributed [4]	30,835	32,621	
Total [5]	176,728	167,890	

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[1] Sweet Grass and Wheatland Counties did not report production.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Daniels and Roosevelt; Dawson and McCone; Fallon, Prairie, and Wibaux; Garfield and Petroleum; and Glacier, Pondera, Teton, and Toole Counties have been combined because of joint oilfield production.

[4] Includes value of gem stones, natural gas, natural-gas liquids, petroleum, sand and gravel, and stone that cannot be assigned to specific counties and values indicated by footnote 2.

[5] Total adjusted to eliminate duplicating the value of stone; 1958 total revised.

company elemental phosphorus plant at Silver Bow. J. R. Simplot Co. did not operate the Centennial Mountain open-pit mine during the year. Talc from the Smith-Dillon mine (Tri-State Minerals Co.) was ground at the company mill at Barratts.

Big Horn.—Recovery of crude oil from the three fields in the county was about the same as in the preceding year, and withdrawals of natural gas declined.

Blaine.—Crude oil production from the Bowes field increased to 333,000 barrels from 277,000 barrels in 1958. Output of natural gas (897 million cubic feet) also was higher. One bituminous-coal mine was active in the county.

Broadwater.—Northern Milling Co., operating the Marietta mine, purchased in 1958, was a leading gold-ore producer in the county. The ore, a complex intergrowth of gold, arsenopyrite, and pyrite, was concentrated and shipped to the Anaconda copper smelter where a penalty was imposed because of the high arsenic content. To reduce this disadvantage, the company was designing and constructing a 200-ton-a-day differential flotation mill to beneficiate the fine-grained ore. A more economical operation was anticipated from the new mill, which would grind the ore finely to free the gold. By careful control of the flotation circuit, a low-arsenic (less than 3 percent) concentrate would be produced and shipped to the East Helena smelter, where the open-schedule no-deduction limit on arsenic is 2 percent. Ore in the Marietta mine is stoped in several adit levels from veins 5 to 9 feet wide in andesite.

Large quantities of silver and lead were recovered from the January Mine, Inc., January mine. The Diamond Hill placer claims were worked for 3 months with a nonfloating washing plant, but small profit was yielded because of high operating costs. Overburden was stripped with a bulldozer and dragline from the ancient riverbed deposit, and 11,400 tons of gold-bearing material was washed in a rotating trommel.

Iron ore (magnetite) was shipped from the Iron Cross mine by Ralls & Harris Bros. Shipments totaling nearly 11,000 long tons went entirely for consumption in the cement industry.

Carbon.—Three companies—Lisbon Uranium Corp., Planet Exploration Corp., and Midland Mining Co.—operated a total of six properties and accounted for all State uranium output. Lisbon Uranium was the leading producer with ore from the Dandy, Marie No. 2, and Perc No. 14 claims. The ore was a low-vanadium, high-lime carnotite-tyuyamunite with a refractory amenability rating.

Value of nonmetals and fuels produced in the county rose to $14.7 million, making the county third in the State for production of these commodities and first for petroleum recovered within a single county. The county was fourth in 1958, with a total output valued at $11.8 million. Crude oil and natural gas output accounted for the increase. About 92 percent of the 4.4 million barrels of petroleum produced came from the Elk Basin field, third-ranking producer statewide. The Dry Creek field yielded 1.5 billion cubic feet of natural gas and maintained fourth position in the State. Two other fields (Clarks Fork and Elk Basin) also had large output. Limestone was quarried at Warren by The Bighorn Limestone Co. and bituminous coal was mined at three locations.

Carter.—Bentonite output from the Alzada pit by Baroid Sales Division, National Lead Co., decreased sharply. Recovery of crude oil from the Repeat field was 17,000 barrels less than in 1958.

Cascade.—The Anaconda Co. Great Falls Reduction Works operated near capacity until it was closed August 19 by a labor strike. During the closure that lasted through December, extensive repairs were made to the base of the large stack, and other plant facilities were reconditioned. The company estimated that 7,000 tons of accumulated flue dust would be removed from the base of the stack and from the flues during the stack repairs and that approximately 2,300 tons of zinc could be recovered from it. Anaconda Wire & Cable Co. aluminum and copper rod, wire, and cable production facilities adjacent to the reduction works reported that sales had improved; however, prices and credit terms continued to be highly competitive, according to The Anaconda Co. annual report.

Anaconda operations at Great Falls also included a copper refinery, which was being modernized, and facilities for recovering indium and cadmium metal as byproducts of zinc refining. Cadmium went to many diverse markets; a comparatively large, new market was created by using it as a galvanizing coating on nails for prepainted exterior siding. Nails so coated do not streak and discolor the finish as do zinc-coated nails. Demand for indium expanded because of its use as an alloy in high-speed bearings and as an additive in high-speed lubricants.

Sand and gravel output rose, but the county was second in the State for production of this commodity, compared with first in 1958. Small quantities of coal (one mine), stone, and clay also were produced. The strike at The Anaconda Co. metallurgical operations resulted in lower production of fire clay from the Armington mine. Robinson Insulation Co. exfoliated vermiculite at its Great Falls plant.

Daniels and Roosevelt.—Because the Bredette-North oilfield extends over the Roosevelt County line into Daniels County, the counties were considered as a unit for reporting purposes. Output of crude oil declined to 3.9 million barrels, compared with 4.2 million barrels in 1958, and the area dropped to fourth place in the State as a source of petroleum. Most of the production came from the Poplar-East field in Roosevelt County. This field dropped to fourth place from third in 1958 as a crude oil source. Recovery from the Bredette-North field was 87,000 barrels, compared with 151,000 barrels in the previous year.

Dawson and McCone.—Recovery of crude oil from the Dawson-McCone County area (combined because the Richey field underlies portions of both counties) was 1.4 million barrels, compared with 1.2 million barrels in 1958. Output from the Richey-Southwest field in McCone County increased 2,000 barrels over output in 1958.

Deer Lodge.—The entire metallurgical facilities of The Anaconda Co. at Anaconda were closed in August because of a smelter strike, which lasted until December 23. Limited operations were resumed before yearend in the copper treatment department. The company annual shareholder report told of the following developments during the year:

> At the Anaconda Reduction Works, storage areas were enlarged for the disposal of waste material from the concentrator. This project includes the installation of facilities to recover 12,000 gallons of water per minute for re-use in the concentrator. Completion of this project is planned for mid 1960.
>
> Late in 1958 and continuing through the first half of 1959, the metallurgical research department successfully developed procedures for the application of an X-ray Quantrol device to the continuous assaying of various concentrator products in order to provide more reliable data for process control. Improved

extraction of metal values from the ore has been achieved by use of this novel adaptation of X-ray equipment.

Plans have been made to improve copper smelting practices by substituting fluosolid roasters for multiple hearth roasters. The roaster calcines and unroasted concentrates will be mixed to make up the feed for the reverberatory furnaces. Conveyors, instead of rail tramming, will be used to transport charge materials directly to the furnaces. These changes will be initiated in 1960.

During the year, organization of the metallurgical research department was strengthened by dividing the work into three major divisions, each headed by an assistant director. Work of the divisions will be in the fields of chemical research, concentration processes, and pyrometallurgy.

As was the case at Great Falls, repairs were made on plant facilities during the long closure. Extensive work was done on the flue system leading to the stack. The ferromanganese plant was idle most of the year because of market conditions and the labor strike. The zinc refinery at Anaconda operated at a reduced rate in order to maintain maximum production at the Great Falls refinery.

The Silver Reef mine, Georgetown mining district, yielded 148 tons of silver ore to the Silver Reef Mining Co., representing the only metal mining in the county.

Limestone mined at Brown's quarry was burned to quicklime for use at The Anaconda Co. ore-processing and metallurgical operations. The company also processed various nonmetals from sources outside the county for use at the Anaconda Reduction Works. Included were pyrite from Silver Bow County base-metal ores, converted to sulfuric acid for use at the phosphate plant; phosphate rock from Conda, Idaho, converted to triplesuperphosphate fertilizer and phosphoric acid; and clay from Cascade County for making refractories.

Fallon, Prairie, and Wibaux.—Value of crude oil and natural gas recovered from the area (considered as a unit for reporting fuel production) totaled $27.2 million; the area ranked first as a source of these commodities. Output included 10.5 million barrels of petroleum and 7.2 billion cubic feet of natural gas. The three-county area contained the first and second ranking oilfields in the State—Pine, 4.8 million barrels (underlies Wibaux, Fallon, and Prairie Counties) and Cabin Creek, 4.3 million barrels (Fallon County).

Cedar Creek field (Fallon County) yielded 5.1 billion cubic feet of natural gas compared with 5.4 billion cubic feet in 1958, and continued in second place in the State. Output of the Pine field was 923 million cubic feet, 70 million cubic feet less than in 1958. Cabin Creek field also contributed a large quantity to the total.

Fergus.—The Cave mine, Warm Springs district, yielded a small quantity of lead ore and showed a small increase over the previous year. A minor quantity of gold ore was recovered from the Black Bull property in the same district.

Gypsum was mined near Heath and Hanover.

Flathead.—Anaconda Aluminum Co., Columbia Falls, operated at 88 percent of capacity from July through the yearend, placing 210 pots in use, compared with 180 for the first 6 months. Employees received an 8.23-cent average hourly wage increase, negotiated by the Aluminum Workers Trades Council. Including fringe benefits, the increase was approximately 23 cents an hour.

Silver ore was mined at the Flathead property, the only producing metal mine in the county.

Gallatin.—The principal mineral industry in the county was the Trident plant of Ideal Cement Co., Montana Division. Value of cement, stone, sand and gravel, and mica output made Gallatin County the leading source of nonmetals in the State. Compared with counties having fuel production, the county placed sixth. Limestone from the Trident quarry was used at the cement plant.

Garfield and Petroleum.—Recovery of petroleum from the Cat Creek Field (underlying Garfield and Petroleum Counties) totaled 151,000 barrels, some 20,000 barrels less than the recovery in 1958.

Glacier, Pondera, Teton, and Toole.—For convenience in reporting fuel production, these four counties were considered as a unit. Cut Bank, the leading gas-producing field and an important source of crude oil, underlies portions of Glacier, Pondera, and Toole Counties. Pondera, another important field lies in Pondera and Teton Counties. The area, with a 3.9-million-barrel output of crude oil, was in third place in the State as a source of crude oil. Principal production by field was Cut Bank, 2 million barrels; Kevin-Sunburst, 833,000 barrels; and Pondera, 521,000 barrels.

Withdrawals of natural gas reached 11.3 billion cubic feet, about 1.7 billion less than the preceding year. Cut Bank (including Reagan), the leading gas-producing field, yielded 10.2 billion cubic feet.

Granite.—Manganese ore mined in the county (Taylor-Knapp Co. from the Moorlight group and Trout Mining Co. [formerly Trout Mining Division] from the Algonquin group) totaled 27,635 tons having a manganese content of 6,607 tons, compared with 42,265 tons of ore containing 4,171 tons of manganese mined in the county in 1958. Taylor-Knapp Co. shipped 5,765 tons of concentrate (44.7 percent manganese) to Denver, Colo., under the GSA small-producers manganese stockpiling program; shipments were terminated by closure of the program in early August. Battery-grade manganese shipments (50 to 65 percent manganese) by the Taylor-Knapp and Trout companies greatly exceeded shipments in 1958.

Trout Mining Co. also recovered much gold, silver, and zinc from the Algonquin properties. The Bear Creek Mining Co., subsidiary of Kennecott Copper Corp., filed claims on a large area southwest of Philipsburg in conjunction with an investigation of copper mineralization.

Jefferson.—The number of lode-mining operations declined to 8, compared with 22 in 1958; the quantity of ore mined dropped 49 percent to 3,291 tons. The largest single operation in terms of ore mined was the Lahey Leasing Co. Alta mine (silver ore). The Hie-Ore (gold-silver ore) and Basin Jib (gold-silver ore) mines were second and third, respectively. A bucket dredge operated on the Prickly Pear placer and recovered substantial values in gold.

An exploration contract for nearly $23,000 was signed by OME with Baltimore Syndicate, Ltd., for exploration of lead-zinc-copper mineral deposits at the Baltimore mine.

Judith Basin.—Iron ore for direct-shipping was mined by the Young-Montana Corp. at the leased Willow Creek open-pit mine near Stanford. Over 37,000 long tons of hematite (63 percent iron and 2.9 percent moisture) was shipped by rail to Duluth, Minn., where it was reloaded for shipment by water to eastern steel companies. Company-owned trucks hauled the ore from a stockpile at the mine to the railhead at Stanford, a distance of 18 miles.

Lewis and Clark.—Lead smelter operations at East Helena of American Smelting and Refining Co. were idled from August 20 to December 11 because of a labor strike called by the International Union of Mine, Mill & Smelter Workers; the union contract expired in June. According to the annual company report to shareholders, 113 production days were lost.

The Anaconda Co. slag-fuming facility, adjacent to the Asarco lead smelter, also was closed by the strike. During the operating period, over 46,000 tons of old slag was fumed, in addition to hot slag received from the lead smelter.

Seven metal mines (excluding dump-slag operations) reported production of small quantities; the largest producer was the Nick and Dick property operated by Louis Peura in the Canyon Ferry district.

Liberty.—Crude oil output continued to decline. Three fields in the county yielded a total of 55,000 barrels (43,000 less than 1958). Production of natural gas increased to 3.9 billion cubic feet from 3.5 billion cubic feet in 1958. Keith Block and Utopia fields each had an output of 1.2 billion cubic feet.

Lincoln.—St. Paul Lead Co., Kellogg, Idaho, and Merger Mines Corp., Coeur d'Alene, Idaho, extracted a small quantity of ore from the Snowshoe mine near Libby. Construction of a 100-ton capacity selective flotation mill was completed, and the mill was placed in operation. Custom milling was to be done for other companies in the area.

Zonolite Co. continued to be the leading producer of crude vermiculite in the Nation. The operation, at Libby, was the only nonmetal mining activity in the county.

Madison.—The West Mayflower mine (owned by The Anaconda Co.) was the leading metal-producing mine in the county out of a total of 14 metal mines. The mine, in the Cedar Hollow district southwest of Cardwell, yielded gold ore, as did most of the other properties.

Talc mining was the only nonmetal mineral industry in the county. Six mines were active. Sierra Talc and Clay Co. operated the Yellowstone mine (near Cameron) and the Beaverhead mine (near Alder). Tri-State Minerals Co. operated the Regal and Treasure State mines (near Dillon). The Sweetwater (near Dillon) and the Ruby (near Alder) mines were run by American Chemet Corp. This company had a screening plant at Alder.

Meagher.—Lead ore was mined from the Cumberland mine, near Lennup, by Cumberland Mines Co. and H. O. Mining Co. Output from this property was slightly lower than in 1958.

Mineral.—Except for several minor placer operations, there was no metal mining in the county. Prospecting by bulldozer revealed a lead-zinc mineralized zone on properties of Mineral King Mining Co. near Saltese. A potential producer was the Nancy Lee mine west of Superior where a planned 200-foot two-compartment shaft was being driven, which reached a depth of approximately 150 feet before yearend. The objective was to reach a silver-lead ore body previously indicated by diamond drilling. A 100-ton mill was available on the property from earlier operations.

Missoula.—Hera Exploration Co. mined and milled 500 tons of copper ore from the Hera mine. Copper concentrate produced by flotation totaled 52 tons. A small quantity of gold ore was recovered from development at the Nine Mile mine.

Mining of barite by Baroid Sales Division, National Lead Co. again was the principal mineral industry in the county. Some sand and gravel and stone also were produced.

Musselshell.—Crude oil production from eight fields in the county totaled 725,000 barrels, 107,000 barrels less than production in 1958. Musselshell County continued to be the principal source of bituminous coal in the State. The output from 10 mines was 128,000 tons, compared with 169,000 tons in 1958. The Roundup No. 3 (Roundup Mining Co.) and the Montana Queen (Mountain States Mining Co.) mines produced most of the coal.

Powell.—Minor quantities of lead and zinc ore were shipped by Golden Anchor Mining & Milling Co. and Northwest Mining & Exploration Co. Hydraulic placer mining on the Ophir property by Francis Slaughtner was curtailed; 3,000 cubic yards of material was washed, compared with 10,000 cubic yards in 1958.

Combined output of phosphate rock from the Anderson and Luke mines (Montana Phosphate Products Co.) and from the operation of George Relyea made the county the leading source of phosphate rock. Production was higher than in 1958. Most of the rock mined by Montana Phosphate Products Co. was shipped to British Columbia for processing. Limestone was calcined by Elliston Lime Co., 18 miles west of Helena.

Ravalli.—Curlew Mining & Exploration Co. of Darby mined lead ore from the Curlew mine near Stevensville.

A small quantity of fluorspar was mined at the Cummings-Roberts Crystal Mountain open pit and trucked to a mill at Darby.

Richland.—Lignite was mined by the Knife River Coal Mining Co. west of Sidney. Output supplied a steam-electric generating facility. Crude oil production from the Brorson field increased to 36,000 barrels.

Rosebud.—The county moved from sixth to fifth position in value of coal and petroleum output ($7.1 million). Recovery of crude oil from the Sumatra field totaled 2 million barrels, about 400,000 barrels more than in 1958. The Stensvad field, brought into production in 1958, produced 1.1 million barrels. Production of bituminous coal was lower than ever before.

Sanders.—Output of lead ore increased significantly at the Jack Waite mine near the Idaho-Montana border, leased by the American Smelting and Refining Co. Exploration and development continued. Raven Mines shipped a small quantity of copper ore from the Raven mine.

Sheridan.—Recovery of crude oil from the Outlook field increased to 590,000 barrels from 499,000 barrels in 1958. Two mines yielded a small quantity of lignite.

Silver Bow.—The county accounted for 99 percent of the State total output of gold, silver, copper, lead, and zinc ore and supplied 95 percent of the State total of value of these metals. Ore tonnage and metal values came almost wholly from mines of The Anaconda Co. Compared with total value of mineral production for the State, value of gold, silver, copper, lead, and zinc output in the county declined from 35 percent (1958) to 30 percent of the total.

Of the 12,244 tons of produced manganese (content of ore) reported for the State, 46 percent came from Silver Bow County mines (virtually all of which was from The Anaconda Co.).

Victor Chemical Works produced phosphate rock from its Maiden Rock mine near Melrose. Rock from this mine and from the Canyon Creek property (Beaverhead County) was processed to elemental phosphorus at the company Silver Bow plant. Pyrite recovered as a byproduct from base-metal ores milled in the county was shipped to Anaconda (Deer Lodge County) for conversion to sulfuric acid.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in Silver Bow County, in terms of recoverable metals

Year	Mines producing	Material sold or treated (thousand short tons)	Gold, lode and placer (troy ounces)	Silver, lode and placer (thousand troy ounces)
1950-54 (average)	20	4,516	18,607	5,709
1955	22	7,160	22,262	5,578
1956	21	9,395	31,132	6,772
1957	19	10,673	27,312	5,069
1958	22	10,745	17,374	3,308
1959	16	8,679	18,615	3,204
1882-1959	------------	(1)	2,291,000	615,250
Year	**Copper (short tons)**	**Lead (short tons)**	**Zinc (short tons)**	**Total value (thousand)**
1950-54 (average)	61,808	15,351	69,735	$62,482
1955	81,428	14,331	62,588	86,240
1956	96,292	14,989	63,375	111,138
1957	91,393	9,617	43,169	73,328
1958	90,557	5,492	26,580	57,942
1959	65,810	4,456	22,459	50,149
1882-1959	7,449,000	396,000	2,279,000	3,426,196

[1] Data not available.

Summit Valley (Butte) District.—Gold, silver, copper, lead, and zinc production for the county came entirely from this district; the 8,679,400 tons of ore produced was 19 percent below production in 1958. The two outstanding ore producers were the Anaconda Co. Berkeley pit and Kelley copper mines, which together yielded 7.7 million tons of ore containing 12,100 ounces of gold, 1.1 million ounces of silver, and 47,700 tons of copper. Smaller quantities of copper ore were extracted by vein-mining operations at the Mountain Con and the Steward mines. The Alice mine yielded silver ore, as did old tailings from the Champion mine; zinc ore was mined from the Anselmo and the Alice pit. Anaconda precipitated over 4 million pounds of copper from mine water.

According to The Anaconda Co. annual report to shareholders, the Butte mines were operated on a 6-day-a-week basis from January 1 to August 19; operations then were suspended by a strike of the International Union of Mine, Mill & Smelter Workers. Production of copper ore at the Berkeley pit was approximately 28,500 tons a day until the strike; 1.75 tons of waste was removed for each ton of ore mined. Production averaged nearly 13,000 tons a day at the Kelley mine until the closure. A new ventilation shaft was completed from the surface to the 1300 level of the Kelley mine. Zinc-ore shipments from the Alice pit (formerly producing siliceous ore for converter flux from an oxidized part of the Alice vein near the surface) were halted early in the year for several months, pending negotiation between The Anaconda Co. and the adjacent city of Walkerville for property near the pit needed to safely continue expansion of the project. A mutual agreement was reached, and operations were resumed April 24. The Elm Orlu-Black Rock low-grade zinc project was resumed July 6 but was idled shortly thereafter by the strike. Mining was to be by block caving, and ore was to be hoisted through the Badger mine shaft. Manganese ore was mined by Anaconda from the Emma mine, which the company allowed to flood during the strike and did not plan to reopen. Manganese derived from the new low-grade zinc development would supply the nodulizing plant and ferromanganese smelter.

The Berkeley pit operation was the subject of several publications during the year.[4]

Plans to build a brass plant employing 50 to 100 men were announced by Sullivan Valve & Engineering Co. The new plant, to be incorporated under the name of Butte Brass Co., would manufacture gas controls, brass valves, and fittings in conjunction with the control division of the Sullivan company. The new company would use locally produced copper and zinc to make brass.

A number of independent mines in the district yielded silver and gold ore; the larger shippers were the Valdemere, Tuxedo, Poser, Marget Ann, and Northern Pacific.

In addition to the major labor strike against The Anaconda Co. in August, a union jurisdictional dispute threatened a work stoppage in March of the Anaconda-owned Butte, Pacific, & Anaconda Railway, which hauled ore from the Butte area mines to the smelting works; however, the walkout was restrained by a Federal court injunction.

Stillwater.—American Chrome Co., subsidiary of Goldfield Consolidated Mines Co., continued shipment of major quantities of chromite concentrate to a Federal stockpile. Ore was mined by shrinkage stoping from the Mouat deposit and trammed downhill for several miles to the company mill at Nye. According to the company annual report to shareholders, work was continued at a pilot smelter located near the mill:

> To test the feasibility of the use of this ore in competition with foreign ore, the pilot ferro-chrome reduction plant, completed at the end of 1958, was operated steadily throughout the year and 2,100 tons of metal was produced. It

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[4] Mining Engineering, vol. 11, No. 3, March 1959: Specifically, the following articles: Goddard, Charles C., Jr., Berkeley Pit—History and Geology, pp. 290–292.
Bonner, E. O., Berkeley Pit—Mining Plan and Operations, pp. 293–297.
Ralph, F., Berkeley Pit—Crushing and Conveying System, pp. 298–300A.
Young, P. M., Berkeley Pit—Servicing Mobile Equipment, pp. 300B–300D.
Renouard, E. I., Berkeley Pit Operation: Min. Cong. Jour., vol. 45, No. 6 June 1959, pp. 51–54.
McWilliams, John R., Mining Methods and Costs at The Anaconda Company Berkeley Pit, Butte, Mont.: Bureau of Mines Inf. Circ. 7888, 1959, 46 pp.

> consisted of various grades of ferro-chrome, mainly of high-carbon 'charge' chrome, 'blocking' chrome, and medium-carbon 'refined' chrome.
>
> These products, which are all saleable to the steel industry, were of uniform grade and high quality, although in the lower chromium content range because of the low chrome to iron ratio of the ore in this deposit.

In addition to the original plant equipment, the company decided to add a refining furnace, which could be used to test production of an alloy with a lower carbon content. The annual report further stated:

> An intensive marketing program is underway, and our efforts appear to be welcomed by the steel industry which has heretofore been entirely dependent upon ferro-chrome produced from foreign ores. Despite the long and crippling steel strike, ferro-chrome was sold during the year to major steel companies who reported favorable results in their use of this alloy. Since the end of the steel strike additional sales have been made, more interest has been generated, and prospects are bright for continuing orders.

Withdrawals of natural gas from the Big Coulee field rose to 852 million cubic feet, compared with 659 million in 1958.

Valley.—Sand and gravel valued at $1.6 million was used by the U.S. Army Corps of Engineers and Bureau of Reclamation at the Glasgow Air Force Base and Milk River project, respectively. The county led the State in production and value of sand and gravel.

Yellowstone.—Crude oil production from the two fields in the county was 532,000 barrels, about 58,000 barrels less than in 1958. Wolf Springs field accounted for most of the output. Elemental sulfur was recovered from hydrogen sulfide gas by Montana Sulphur & Chemical Co. north of Billings.

The Mineral Industry of Nebraska

By D. H. Mullen[1]

◆

MINERAL production in Nebraska in 1959 advanced to a new peak for the 12th consecutive year, and its value reached $100.2 million, an increase of $10.2 million, or 11 percent, over 1958. Although gains were reported for all mineral commodities, the mineral fuels (natural gas, natural-gas liquids, and petroleum) accounted for 74 percent of the value of mineral production and 97 percent of the increase in total value. Output of petroleum increased 3.3 million barrels over 1958. This increase was the result of the most active year in the State's history in exploration and development drilling. Forty-one new fields were discovered, and 253 successful development wells were completed. Drilling totaled 5.4 million feet (2.4 million exploratory and 3 million development), exceeding that of 1956, the previous record year for this activity. Exploration in the western counties extended production areas 2 to 4 miles beyond previous field limits, mostly toward the west, and important discoveries were made east of the Chadron-Cambridge arch in Hitchcock and Red Willow Counties.

TABLE 1.—Mineral production in Nebraska[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	108	$110	131	$133
Gem stones	(2)	2	(2)	3
Natural gas......million cubic feet	11,405	1,711	[3] 19,100	[3] 2,900
Natural-gas liquids:				
Natural gasoline......thousand gallons	10,870	727	(4)	(4)
LP-gases......do	31,178	1,565	(4)	(4)
Petroleum (crude)......thousand 42-gallon barrels	20,373	59,897	[3] 23,669	[3] 68,167
Sand and gravel	10,441	7,945	11,202	8,301
Stone	3,555	4,747	3,236	5,235
Value of items that cannot be disclosed: Cement, pumice, and values indicated by footnote 4		14,603		17,679
Total Nebraska[5]		90,047		100,213

[1] Production as measured by mine shipments, sales, or marketable production(including consumption by producers).

[2] Weight not recorded.

[3] Preliminary figure.

[4] Figure withheld to avoid discolsing individual company confidential data; value included with "Items that cannot be disclosed."

[5] Total has been adjusted to eliminate duplicating the value of clays and stone.

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[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

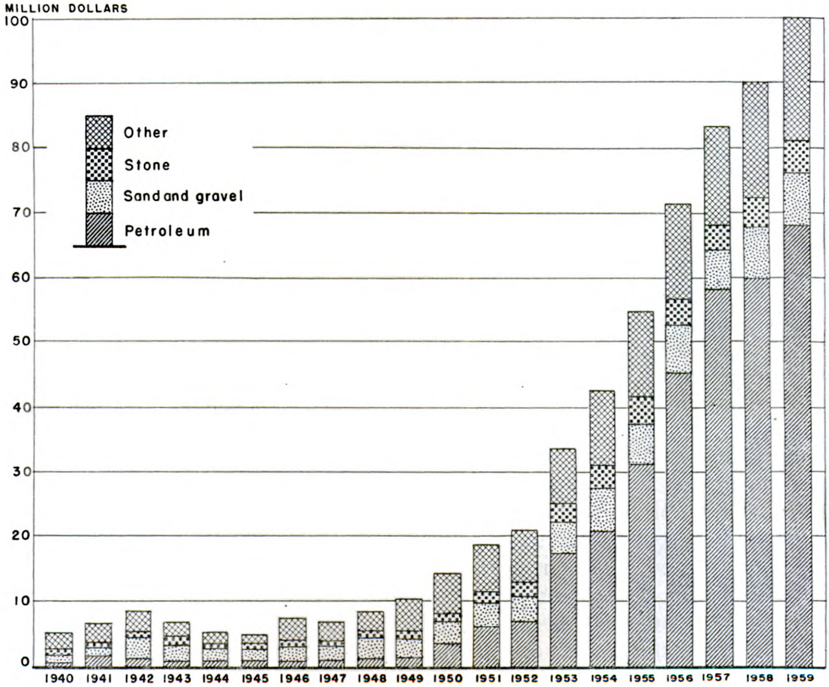

FIGURE 1.—Value of petroleum, sand and gravel, and stone, and total value of mineral production in Nebraska, 1940–59.

Employment.—Employment in the mineral industries averaged 2,700 workers. General contractors, excepting building and special-trade contractors, employed an average of 4,900 people. General contractors included contractors engaged in constructing roads and building highway bridges, who required sand and gravel and crushed stone for use on the projects. In 1958 the mining industry employed an average of 2,300 people and general contractors employed 4,800 persons. Total employment in all nonagricultural occupations averaged 363,800, an increase of 4 percent over 1958.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Natural Gas.—Natural gas from Big Springs field in Deuel County, Huntsman and West Sidney fields in Cheyenne County, and Long field in Kimball County was marketed through pipelines to consumers after processing in natural gasoline plants. The quantity sold in 1959 was 67 percent greater than in 1958. Capacity of the four processing plants was 83.5 million cubic feet per day; throughput was approximately 62 million cubic feet per day.

Natural-Gas Liquids.—Natural gasoline, butane, and propane were recovered at natural gasoline plants in Deuel, Cheyenne (two), and Kimball Counties. The quantity recovered in 1959 was 12 percent above that in 1958. The plant in Deuel County was an absorption and refrigeration plant, and the other three were absorption plants.

TABLE 2.—Production of crude petroleum, by counties

(Thousand barrels)

County	1958	1959 (preliminary)	Principal fields in 1959 in order of production
Banner	3,881	7,303	Willson Ranch, Singleton, Barrett, Lewis, Kenmac.
Cheyenne	4,679	4,155	Cook, Juelfs, Spearow.
Garden	9	7	Richards, McCord.
Harlan	5		
Hitchcock	1	75	Reiher, Burr Oak, Frakes.
Kimball	10,694	11,026	Sloss, Southwest Potter, Simpson, Allchin.
Morrill	934	933	Olsen, Lane, Craig.
Red Willow	14	13	Barger, Poore.
Richardson	143	142	Dawson, Falls City.
Scotts Bluff	13	15	Vessels.
Total	20,373	23,669	

TABLE 3.—Wildcat- and development-well completions in 1959, by counties

[Oil and Gas Journal]

County	Crude	Gas	Dry	Total	Footage
WILDCAT					
Banner	16		128	144	889,100
Chase			5	5	16,600
Cheyenne	5		59	64	333,000
Dawes			2	2	5,300
Douglas			1	1	2,400
Dundy			2	2	10,600
Frontier			1	1	4,200
Hitchcock	3		4	7	31,900
Keith			1	1	1,800
Kimball	15		125	140	929,500
Lincoln			3	3	10,900
Morrill	1		25	26	120,800
Red Willow	1		4	5	20,800
Scotts Bluff			7	7	36,300
Sioux			1	1	4,800
Washington			1	1	1,700
Total	41		369	410	2,419,700
DEVELOPMENT					
Banner	95		70	165	986,300
Cheyenne	29	1	24	54	279,600
Deuel			2	2	6,700
Hitchcock	9		5	14	58,000
Kimball	112		137	249	1,597,400
Morrill	6		9	15	74,300
Richardson	1			1	3,300
Total	252	1	247	500	3,005,600
Total, all drilling	293	1	616	910	5,425,300

Petroleum.—Overall petroleum production from 236 fields in 10 counties increased 16 percent over 1958, but declines in production were noted in some of the older fields because of gradual depletion of the producing horizons. However, some of the more recently discovered fields provided substantial additions to the total production and more than offset any losses. At the end of the year there were more than 1,500 producing wells. The level of exploratory and development drilling was the highest in the State's history; 910 wells were completed, compared with 728 wells in 1958 and 900 in 1956, the previous record year. Of these, 410 were exploratory and 500 were development wells. Forty-one discoveries were listed, making the success ratio 10 percent, or slightly below that of 1958. Development drilling resulted in 1 gas well and 252 oil wells, a success ratio of 51 percent. Most of the exploration drilling was centered in Banner, Cheyenne, and Kimball Counties. These counties accounted for 88 percent of all exploratory drilling and 36 of the State's 41 discoveries, all in Cretaceous formations. Other discoveries were in Hitchcock and Red Willow Counties, where successful wells were completed east of the Chadron-Cambridge arch and just north of the Nebraska-Kansas line in the Pennsylvanian formation. Development drilling also was centered largely in Banner, Cheyenne, and Kimball Counties; of the 253 successful development wells completed, 237, or 94 percent, were in these counties. Other development wells were in Morrill, Hitchcock, and Red Willow Counties.

The Nebraska Legislature created a State Oil and Gas Conservation Commission during the 1959 session, and a three-man commission was appointed. Hearings began late in the year to study the establishment of maximum rates of efficient production for the larger Nebraska fields.

NONMETALS

Cement.—Shipments of portland and masonry cements from plants in Cass and Nuckolls Counties increased slightly over 1958. The eight kilns at the two plants operated an average of 342 days, and production was nearly 100 percent of capacity. Limestone and shale used in manufacturing the cements were mined at quarries near the plants and at a limestone quarry in Kansas. Portland cement was used at one plant as a base for masonry cement; and at the other, cement clinker was used. Most of the output was shipped to consumers in Nebraska (76 percent) and Iowa (18 percent); small quantities went to South Dakota, Minnesota, and Kansas. Prices of cement in 1959 averaged $3.31 a barrel for portland and $4.23 for masonry.

Clays.—Clay production in five counties was 21 percent greater than in 1958. Miscellaneous clay was used for manufacturing cement, building brick, draintile, sewer pipe, and other heavy clay products. Stoneware clay from Cass County was used in making art pottery and flowerpots.

Gem Stones.—Gem material, including fossils, agate, petrified wood, jasper, chalcedony, and crystalline barite (called Odell diamonds) was collected by various individuals and gem societies.

Perlite.—Crude perlite from deposits in western States was expanded by Western Mineral Products Co. at its plant in Omaha for use in building plaster, as a concrete aggregate, and as a paint additive.

Pumice.—Pumice production from deposits in Custer County was approximately the same as in 1958. After grinding and sizing, the crude pumice was used in cleaning and scouring compounds and as an abrasive.

Sand and Gravel.—Sand and gravel production, reported from 59 of the State's 93 counties, increased 7 percent over 1958, and commercial operators in 55 counties produced 93 percent of the State total.

Government-and-contractor operations were reported in 19 counties, and of the total tonnage 62 percent was produced by county crews. Building and paving consumed 97 percent of the total production, of which 38 percent was used for building construction and 62 percent for paving and road building. The remainder was used for railroad ballast, blast sand, engine sand, fill material, and miscellaneous purposes. A high proportion (76 percent) of the total output was washed, screened, and otherwise prepared. Buffalo County led the State in the quantity of sand and gravel produced, followed by Dodge and Cass Counties. These counties produced more than 1 million tons each. Three counties—Douglas, Sarpy, and Hall—produced more than 500,000 tons each, and 17 counties produced more than 100,000 tons each.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	806	$556	1,985	$1,534
Paving	907	645	762	575
Blast	---	---	5	5
Engine	(1)	(1)	1	1
Railroad ballast	(1)	(1)	(1)	(1)
Fill	126	62	132	81
Other	7	5	30	12
Total	1,846	1,268	2,915	2,208
Gravel:				
Building	2,971	2,520	2,110	1,756
Paving	4,883	3,621	5,182	3,594
Railroad ballast	---	---	1	1
Fill	47	37	33	27
Other	17	20	164	109
Total	7,918	6,198	7,490	5,487
Total sand and gravel	9,764	7,466	10,405	7,695
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	52	35	78	30
Gravel:				
Building	625	444	---	---
Paving	---	---	719	576
Total	625	444	719	576
Total sand and gravel	677	479	797	606
ALL OPERATIONS				
Sand	1,898	1,303	2,993	2,238
Gravel	8,543	6,642	8,209	6,063
Total	10,441	7,945	11,202	8,301

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other" sand.

Progress in road construction in 1959, through Federal-aid projects, as reported[2] by the U.S. Department of Commerce, Bureau of Public Roads, included completion of 4.7 miles and 10 bridges on the National

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[2] Bureau of Public Roads, Status of Federal Aid Programs, December 1959: Press release BPR60-3.

System of Interstate and Defense Highways: 31.4 miles and 42 bridges were under construction at yearend.

Stone.—The production of crushed and broken limestone in 16 counties declined 9 percent compared with 1958. Principal uses of this material were for concrete aggregate and road construction, agriculture, and cement manufacture. Other uses included whiting manufacture, asphalt filler, and mineral food. Riprap and crushed stone for concrete aggregate and road construction accounted for 66 percent of the total production. Counties producing over 100,000 tons were Cass (1,709,500), Sarpy (396,700), Saunders (379,400), Nemaha (284,700), and Otoe (127,300). Rubble for rough construction was produced in Cass and Lancaster Counties. Government-and-contractor operations in four counties produced crushed limestone for riprap and road construction.

Talc.—Crude talc from mines in California and Montana was ground by Sierra Talc and Clay Co. at its plant in Grand Island. The ground material was used in ceramics and toilet preparations and as a filler in paint, paper, rubber, and textiles.

Vermiculite.—Western Mineral Products Co. exfoliated crude vermiculite from mines in Montana at its plant in Omaha. The prepared product was used for loose-fill insulation and as an aggregate in plaster.

METALS

Although no metals were mined in Nebraska, numerous manufacturing plants in the State used ferrous and nonferrous metals. The American Smelting and Refining Co. refined lead bullion from smelters in other States at its Omaha refinery. The plant also recovered antimonal lead, antimony, and bismuth from the bullion processed.

REVIEW BY COUNTIES

Banner.—Banner County advanced to second place in the State in petroleum production (surpassing Cheyenne County) with an output of 7.3 million barrels, an increase of 3.4 million barrels (87 percent) over 1958. Production came from 371 wells in 45 fields. The major fields were the Willson Ranch, Singleton, Barrett, Lewis, and Kenmac. The Singleton, Barrett, and Kenmac fields were 1958 discoveries and produced 983,765, 939,792, and 409,450 barrels of oil, respectively. Exploratory drilling was extensive, and 144 wells were completed. An important discovery was the Brinkerhoff field, completed in June, which pumped 500 barrels of oil a day from the J sandstone member of the Dakota formation from a depth of 6,621 to 6,629 feet. The Midwest field, completed in June, was of interest because of its location in the northwestern edge of the main producing area of the Denver-Julesburg basin; initial production was 125 barrels of oil a day from the J sandstone member of the Dakota formation at a depth of 6,596 to 6,610 feet. A new producing horizon, D sandstone, was discovered east of and contiguous to the Panam field, a 1957 discovery; initial production was 476 barrels a day from a depth of 6,262 to 6,280 feet. Other discoveries were significant because of their location along the extreme western edge of the productive area in western

Nebraska. Development drilling also was rewarding; of 165 wells completed, 95 were successful. At the Singleton field, a 1958 discovery, 29 new producing wells were added. Other development included new producing wells at the Willson Ranch field (10) and Kenmac field (6).

TABLE 5.—Value of mineral production in Nebraska, by counties [1]

County	1958	1959 [2]	Minerals produced in 1959 in order of value
Adams	$48,392	$10,700	Sand and gravel.
Antelope	(3)	(3)	Do.
Banner	11,433,940	21,050,740	Petroleum, sand and gravel.
Blaine	(3)	----------	
Boone	(3)	(3)	Sand and gravel.
Boyd	21,500	16,900	Do.
Brown	60,500	37,100	Do.
Buffalo	268,600	523,000	Do.
Butler	30,900	45,500	Do.
Cass	13,100,191	14,709,533	Cement, stone, sand and gravel, clays, gem stones.
Cedar	65,100	63,400	Sand and gravel.
Chase	----------	2,800	Do.
Cheyenne [4]	13,756,260	11,966,400	Petroleum.
Clay	94,700	136,100	Sand and gravel.
Colfax	67,000	74,300	Do.
Cuming	(3)	(3)	Do.
Custer	(3)	64,200	Pumice, sand and gravel.
Dawes	----------	(3)	Gem stones.
Dawson	148,300	131,525	Sand and gravel, gem stones.
Deuel [4]	----------	----------	
Dixon	37,000	42,700	Sand and gravel, stone.
Dodge	812,800	836,800	Do.
Douglas	914,975	781,151	Sand and gravel, clays.
Dundy	(3)	----------	
Fillmore	36,000	105,800	Sand and gravel.
Franklin	65,200	32,000	Do.
Frontier	2,200	5,000	Stone.
Furnas	68,500	103,900	Sand and gravel.
Gage	223,730	264,150	Sand and gravel, stone, gem stones.
Garden	26,460	20,160	Petroleum.
Grant	3,500	----------	
Greeley	3,700	----------	
Hall	352,800	361,800	Sand and gravel.
Hamilton	5,500	65,400	Do.
Harlan	35,500	17,400	Do.
Hayes	(3)	(3)	Do.
Hitchcock	80,340	236,300	Petroleum, sand and gravel.
Holt	87,500	71,100	Sand and gravel.
Jefferson	307,577	294,085	Sand and gravel, clays.
Kearney	148,800	37,500	Sand and gravel.
Keith	119,100	28,200	Do.
Kimball [4]	[5] 31,471,340	31,764,460	Petroleum, sand and gravel.
Knox	76,300	160,600	Sand and gravel.
Lancaster	244,209	175,645	Stone, clays, sand and gravel.
Lincoln	32,325	10,000	Sand and gravel.
Loup	(3)	----------	
Madison	239,100	219,600	Sand and gravel.
Merrick	92,500	4,400	Do.
Morrill	2,852,160	2,761,340	Petroleum, sand and gravel.
Nance	63,115	65,150	Sand and gravel, gem stones.
Nemaha	606,500	(3)	Stone.
Nuckolls	(3)	(3)	Cement, sand and gravel, stone.
Otoe	(3)	(3)	Stone, clays.
Pawnee	889,700	129,800	Stone.
Perkins	18,400	36,500	Sand and gravel.
Phelps	----------	124,900	Do.
Pierce	81,700	92,800	Do.
Platte	433,600	493,600	Do.
Polk	----------	5,000	Do.
Red Willow	95,860	90,040	Sand and gravel, petroleum, stone.
Richardson	731,020	568,460	Petroleum, stone, sand and gravel.
Rock	(3)	----------	
Saline	40,600	35,600	Sand and gravel, stone.
Sarpy	956,000	1,362,800	Do.
Saunders	895,500	771,650	Stone, sand and gravel, gem stones.
Scotts Bluff	102,520	200,800	Sand and gravel, petroleum.
Seward	(3)	(3)	Stone.
Sioux	20,615	(3)	Sand and gravel, gem stones.

See footnotes at end of table.

TABLE 5.—Value of mineral production in Nebraska, by counties [1]—Continued

County	1958	1959 [2]	Minerals produced in 1959 in order of value
Stanton	(3)	(3)	Sand and gravel.
Thayer	(3)	$72,400	Do.
Thomas	$46,200	300	Do.
Thurston	10,400		
Valley	39,600	(3)	Sand and gravel.
Washington	92,700		
Webster	117,000	(3)	Sand and gravel.
Wheeler	3,700		
York	(3)	(3)	Sand and gravel.
Undistributed [4]	[5] 8,627,309	11,135,943	
Total [7]	[5] 90,047,000	100,213,000	

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[1] The following counties are not listed because no production was reported: Arthur, Box Butte, Burt, Cherry, Dakota, Garfield, Gosper, Hooker, Howard, Johnson, Keya Paha, Logan, McPherson, Sheridan, Sherman, and Wayne.

[2] Natural gas, natural-gas liquids, and petroleum values are preliminary.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Excludes natural gas and natural-gas liquids.

[5] Revised figure.

[6] Includes all natural gas, natural-gas liquids, some sand and gravel and gem stones that cannot be assigned to specific counties and values indicated by footnote 3.

[7] Total has been adjusted to eliminate duplicating the value of clays and stone.

At the Barrett field, a 1958 discovery lying in Banner and Kimball Counties, 16 new producing wells were completed in Banner County.

Buffalo.—The county led the State in production of sand and gravel. Output by nine commercial operations and the county highway department was 1.2 million tons. Principal uses were for building and paving. Major producers were Whitney Sand & Gravel, Johnson Sand & Gravel, and Morgan & Leonard.

Cass.—Ash Grove Lime & Portland Cement Co., the leading cement producer in the State, made portland and masonry cements at its Louisville plant. Limestone and shale used at the plant were mined from nearby deposits. The county was third in the State in production of sand and gravel. The major producers were Lyman-Richey Sand & Gravel Corp. and Western Sand & Gravel Co.

Cheyenne.—The county dropped to third in the State in production of petroleum. Production from 346 wells in 61 fields was 4.2 million barrels, 11 percent under that of 1958. Major producing fields were Cook, Juelfs, and Spearow. Five new oilfields and a gasfield were discovered; all were along the western edge of the county and not directly associated with the producing areas to the east. The most interesting discoveries were the gas well completed in the Rohlfing field (discovered in 1954) and the Hendriks field 2 miles directly west of the gas well. The gas well, completed in September, produced 1.3 million cubic feet a day from the J sandstone at a depth of 5,186 to 5,192 feet; the Hendriks field, completed in June, pumped 150 barrels of oil a day from the D sandstone. Of 29 successful development wells completed, 5 were in the Murfin field and 4 in the Cook field. Ohio Oil Co. operated its Huntsman and West Sidney natural gasoline absorption plants at Sidney. Throughput of the two plants exceeded 19 million cubic feet of gas a day, with a recovery of 15,000 gallons of natural gasoline, 17,000 gallons of butane, and 24,000 gallons of propane. Residual gas was marketed through pipelines to consumers.

Deuel.—Natural gas from the Big Springs field was processed by Kansas-Nebraska Gas Co., Inc., at its Big Springs plant. Daily throughput of the plant was 35 million cubic feet of gas, with a recovery of 3,300 gallons of natural gasoline, 12,000 gallons of propane, and 3,500 gallons of butane. Residual gas was marketed through company pipelines to consumers.

Dodge.—The county ranked second in the State in production of sand and gravel. Total production, in excess of 1.1 million tons (1.3 million tons in 1958), was used for building (80 percent) and paving (20 percent). Major producers were Lyman-Richey Sand & Gravel Corp. at its Nos. 12 and 13 plants, Christensen Sand & Gravel Co., and Lincoln Sand & Gravel Co. Uehling Fertilizer Service crushed limestone for agricultural use.

Douglas.—Sand and gravel for building and road construction was produced by Lyman-Richey Sand & Gravel Corp. at its Nos. 9 and 11 plants, J. W. McCann Co., Hartford Sand & Gravel Co., and Acme Sand & Gravel Co. Omaha Brick Works mined miscellaneous clay for manufacturing building brick, tile, and other heavy clay products. Western Mineral Products Co. expanded perlite and exfoliated vermiculite at its Omaha plant. Crude materials were from mines in western States. American Smelting and Refining Co. refined lead bullion at its Omaha plant and recovered antimony, antimonial lead, and bismuth as byproducts.

Garden.—Petroleum production, from three wells in the McCord and Richards fields, was 22 percent below 1958. No exploratory or development drilling was done in 1959.

Hall.—Sand and gravel was produced by eight companies for building, paving, and fill. Sand was used principally for building, and most of the gravel was used for road construction and paving. Major producers were H & M Equipment Co., Luther & Maddox, and Third City Sand Co. Sierra Talc & Clay Co. ground crude talc from mines in California and Montana at its plant at Grand Island.

Hitchcock.—Petroleum production from three fields increased substantially over that in 1958. At the Burr Oak field, reported as a 1958 discovery, one successful development well was completed. In May an exploratory well 2 miles northwest of the Burr Oak field was completed as a discovery, and the field was named Reiher. Initial production was 348 barrels of oil a day on pump from the Pennsylvanian, Lansing-Kansas City formation, and the well was the largest producer in western Nebraska east of the Denver-Julesburg basin. Drilling of offset wells to the north and east was started before the original well was completed, and both produced substantial quantities of oil. By the end of the year there were eight producing wells in the field. In July a second discovery, Frakes, was recorded. Initial production was 184 barrels of oil a day, on pump, from the Lansing-Kansas City formation at a depth of 3,880 to 4,001 feet. An east offset well and a southeast stepout well failed to produce oil in commercial quantities and were abandoned.

Jefferson.—Miscellaneous clay was mined by Endicott Clay Products Co. for manufacturing building brick, tile, and other heavy clay products. The Fairbury pit of Western Brick & Supply Co. remained idle. Sand and gravel for building and paving was produced by five firms and by contractors for the county highway department. Major producers were Consolidated Sand & Gravel Co. and R. M. Weblemoe Co. Production totaled 331,900 tons.

Kimball.—Petroleum production from 687 wells in 109 fields was 11 million barrels, an increase of 3 percent over 1958. The county retained its position as the leading producer of petroleum in the State with 47 percent of the total. The major producing fields were Sloss, Southwest Potter, Simpson, and Allchin, but 12 other fields produced more than 200,000 barrels each. These 16 fields produced 70 percent of all petroleum in the county in 1959. None of these fields had been discovered before 1951, and 11 were discovered in 1955 or later. Exploratory drilling was particularly successful, with 15 discoveries from 140 completed wells. The most notable included the Bartow field in an area of relatively little previous drilling. Completed in February, the discovery well pumped 375 barrels a day from the J sandstone at a depth of 6,906 to 6,911 feet. By the end of the year, 10 producing wells had been drilled and production from the field exceeded 300,000 barrels. The Nichols field, completed in September, pumped 672 barrels of oil a day from the J sandstone at a depth of 6,429 to 6,434 feet. Other discoveries were the Schomer (240 barrels a day), Painter (300 barrels a day), Russell (225 barrels a day), Bergquist (210 barrels a day), and Spath (190 barrels a day); all produced from the J sandstone. Development drilling resulted in 112 producing wells from 249 completed wells. In the Simpson field, a 1958 discovery, 20 new producing wells were completed. At the Mintken field, a 1958 discovery that was merged with the Signet field, seven new producing wells were drilled. Ten new producing wells were completed in the Vrtatko field, a 1954 discovery, and four new producing wells were drilled in the Kimball County part of the Barrett field.

The most complex unit agreement in the history of the State was completed for the Kimball field in September. Pan American Petroleum Corp., the unit operator, began a waterflood project in the field, and the unit agreement was signed by 700 royalty owners and 600 working-interest owners. Part of the field is under town lots in Kimball, and this accounts for the complexity of the agreement. Kimball Gas Products Co. operated its absorption plant at Long field near Kimball and recovered natural gasoline, propane, and butane. Daily throughput of the plant was 7.8 million cubic feet of gas, with a recovery of 19,000 gallons of natural gasoline, 29,200 gallons of propane, and 6,800 gallons of butane.

Lancaster.—Yankee Hill Brick Manufacturing Co. mined miscellaneous clay for manufacturing building brick, drain and sewer tile, and other heavy clay products. Limestone for concrete, road construction, and agricultural use was crushed by Schwarck Quarries, Inc. The corporation also produced rubble for rough masonry construction. Crushed and broken limestone for riprap and road construction was produced by the county highway department. Contractors mined sand and gravel for the State highway department.

Morrill.—Petroleum production from 56 wells in 9 fields was approximately the same as in 1958. Major producing fields were the Olsen, Lane, and Craig. One new field was discovered in October as a result of drilling 26 exploratory wells. Of 15 wells drilled, 6 were successful development wells, 5 of which were in the Waitman field discovered in 1957. Lyman-Richey Sand and Gravel Corp. produced sand and gravel for building and paving at its No. 23 plant.

Nemaha.—Colaska Production Co. and Nelson Quarries, Inc., produced crushed and broken limestone for riprap, road construction, and agricultural use.

Nuckolls.—Ideal Cement Co. produced portland and masonry cements at its Nebraska Division plant at Superior, which operated at full capacity 347 days during the year. Cement clinker was used as a base in manufacturing masonry cement. Limestone used at the plant was mined at a company-owned quarry in Jewell County, Kans. C. F. Bondegard and Deweese Sand & Gravel Co. produced sand and gravel for building and paving and for use as fill.

Red Willow.—Petroleum production from three wells in the Barger and Poore fields declined slightly from that of 1958. One new field was discovered 10 miles northeast of the one-well Poore field. The new field, named Ackman, was completed in November and pumped 122 barrels of oil a day from the Lansing-Kansas City formation at a depth of 3,307 to 3,310 feet. Offset and extension wells to the north and south had not been completed at the end of the year, but tests indicated commercial oil would be developed. This field, as well as discoveries in adjacent Hitchcock County, had generated considerable interest in the deeper Pennsylvanian formations. Broken limestone (riprap) for the Frenchman-Cambridge project was produced for the Bureau of Reclamation, U.S. Department of the Interior. Sand and gravel for building and paving was produced by Davidson-Merritt Sand & Gravel Co. (30,400 tons), Gillen Sand & Gravel Co. (16,900 tons), and Midwest Sand & Gravel Co. (27,700 tons).

Richardson.—Petroleum was produced at the Barada, Dawson, Falls City, and Snethen fields, and one successful development well was completed. Paving gravel was produced by the Harmon Gravel Co. George W. Kerford Quarry Co. produced 97,000 tons of broken limestone for use as riprap. Broken limestone was produced for the U.S. Army Corps of Engineers.

Sarpy.—The county ranked second in production of stone and fifth in production of sand and gravel. Crushed limestone for riprap, concrete, and road construction was produced by City Wide Rock & Excavating Co., Stone Products, Inc., and Meadow Rock Co. Production totaled 396,700 tons. Sand and gravel for building, paving, and fill was produced by Lyman-Richey Sand & Gravel Corp. at its Nos. 2 and 7 plants, Richfield Sand and Gravel Co., and the county highway department. Total production was 786,100 tons.

Saunders.—Meadow Rock Co. crushed limestone for riprap (2,400 tons), road construction (360,000 tons), and agricultural use (10,000 tons). Sand and gravel for building, paving, and fill was produced by Thomas Construction Co. and Wolf Sand & Gravel Co. at its Cedar Bluffs, Leshara, and Morse Bluffs plants.

Scotts Bluff.—Petroleum production from the one-well Vessels field increased 15 percent over 1958, but seven exploratory wells were failures. The Consumers Cooperative Refinery Association operated its 2,200-barrel-a-day skimming and cracking plant throughout the year. Throughput was 908,187 barrels, a slight increase over 1958. Crude oil came from the Harrisburg field in Banner County and from fields in southeastern Wyoming. Sand and gravel for building, paving, and fill was produced by Trettenero Sand & Gravel Co. and the county highway department.

The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Nevada Bureau of Mines.

By L. E. Davis[1] and R. Y. Ashizawa[2]

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THE HIGHER VALUE for 1959 Nevada mineral production, compared with 1958, ended the downward trend that followed the record high of 1956. The nearly $2 million increase in 1959 resulted from greater outputs of nonmetallic minerals, which more than offset losses in metal production attributed to a 4-month strike by mine, mill, and smelter workers. The nonmetals accounted for 29 percent of the total mineral value in 1959, a gain of 7 percent over the previous year.

Most mineral commodities directly or indirectly connected with the steel industry were unaffected by the prolonged steelworker strike. Export trade was at a high level for both iron ore and magnesite producers, and outputs exceeded those in 1958. The value of the magnesite production, however, was lower because relatively larger volumes of semifinished products were sold. Tonnages of sand and gravel, lime, gypsum, diatomite, and volcanic cinder in 1959 were well above preliminary estimates, and reflected a comparatively good year for the construction industry.

Significant developments during 1959 were: Extensive exploration for beryllium ore at Mount Wheeler Mines, White Pine County; completing and using the skip-haulage system by Kennecott Copper Corp. at its Liberty pit, White Pine County; enlargement of facilities at Basic, Inc., Nye County, including operation of the new 500-ton-per-day flotation plant; location of a new manganese ore body, and operation of the Hulin pit by Manganese, Inc., Clark County; and an extensive drilling program in Washoe, Churchill, Eureka, and Lyon Counties for geothermal steam by a California power company.

Employment and Injuries.—Employment statistics collected and compiled by the Federal Bureau of Mines, in cooperation with the Nevada State Inspector of Mines, disclosed an overall 1-percent increase in employment in the mineral industries over 1958. Employment closely followed production values in the commodity groups, off 8 percent in the metals group (a production-value decrease of 6 percent) and up 24 percent in the nonmetals group (production-value increase of 33 percent).

Although fatal injuries were double those of the previous year, nonfatal lost-time injuries were lower in both commodity groups, and total injuries per thousand workers were 32 percent less in 1959. Three fatalities in October were at the Mohawk mine, Esmeralda County. Mine inspectors for the State of Nevada and the Federal Bureau of Mines gave testimony blaming weather, hidden rock faults, and con-

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TABLE 1.—Mineral production in Nevada[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Antimony ore and concentrate (antimony content)	39	$8	10	$2
Barite	59,407	405	91,298	623
Copper (recoverable content of ore, etc.)	66,137	34,788	57,375	35,228
Fluorspar	12,338	340	16,743	407
Gem stones	(2)	100	(2)	100
Gold (recoverable content of ores, etc.) troy ounces	105,087	3,678	113,443	3,971
Gypsum	686,000	2,306	818,000	2,738
Iron ore (usable) long tons, gross weight	594,000	3,149	698,000	3,712
Lead (recoverable content of ores, etc.)	4,150	971	1,357	312
Manganese ore (35 percent or more Mn) gross weight [3][4]	127,322	7,566	56,586	3,917
Mercury 76-pound flasks	7,336	1,681	7,156	1,628
Petroleum (crude) thousand 42-gallon barrels	40	69	[5] 32	(6)
Sand and gravel	5,503,000	5,311	6,435,625	7,522
Silver (recoverable content of ores, etc.) troy ounces	932,728	844	611,135	553
Stone	813,000	1,335	840,177	1,587
Talc and soapstone	5,391	41	5,824	50
Zinc (recoverable content of ores, etc.)	91	19	217	50
Value of items that cannot be disclosed: Brucite, clays, diatomite, lime, magnesite, molybdenum concentrates (content), perlite, pumice (volcanic cinder), salt, sulfur ore, tungsten concentrate (60-percent WO_3 basis), uranium ore, and values indicated by footnote 6		6,020		8,454
Total Nevada [7]		68,293		70,159

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Weight not recorded.

[3] Includes concentrates and nodules.

[4] Shipment to Government low-grade depots and custom mills not included, but quantity and value of this material are as follows: 1958—low grade manganese ore, 1,774 short tons, $82,835; 1959—manganese ore, 25 short tons, $1,139, and low-grade manganese ore, 200 short tons, $4,140.

[5] Preliminary figure.

[6] Figure withheld to avoid disclosing company confidential data.

[7] Total adjusted to eliminate duplicating the value of stone.

cussion for the massive cave-in. The bodies of the three men were not recovered.

Average weekly earnings per employee, reported by the Nevada Employment Security Department, climbed from $101.10 in 1958 to $108.88 in 1959 for a workweek that averaged 40 hours 45 minutes (1 hour 34 minutes longer).

Consumption, Trade, and Markets.—Mineral production of both metal and nonmetal commodities was reported from each of Nevada's 17 counties during 1959. Total consumption within the State was limited to clays, salt, sand and gravel, and stone except limestone. Nevada industries consumed part of the gypsum, limestone, perlite, and volcanic cinder, which in some instances were processed further for out-of-State customers. Most metal ores were concentrated or further processed before shipment. However, as Nevada has only one smelter (copper) and no refineries, the ores, concentrates, and residues were either consigned to mills and smelters in neighboring States or sold directly to consumers. Comparatively good export trade was enjoyed by producers of iron ore and concentrate, magnesite and magnesia products, and crude perlite. Titanium minerals were imported and processed to the metal and its alloys, and imported manganese ores were treated to produce electrolytic manganese dioxide.

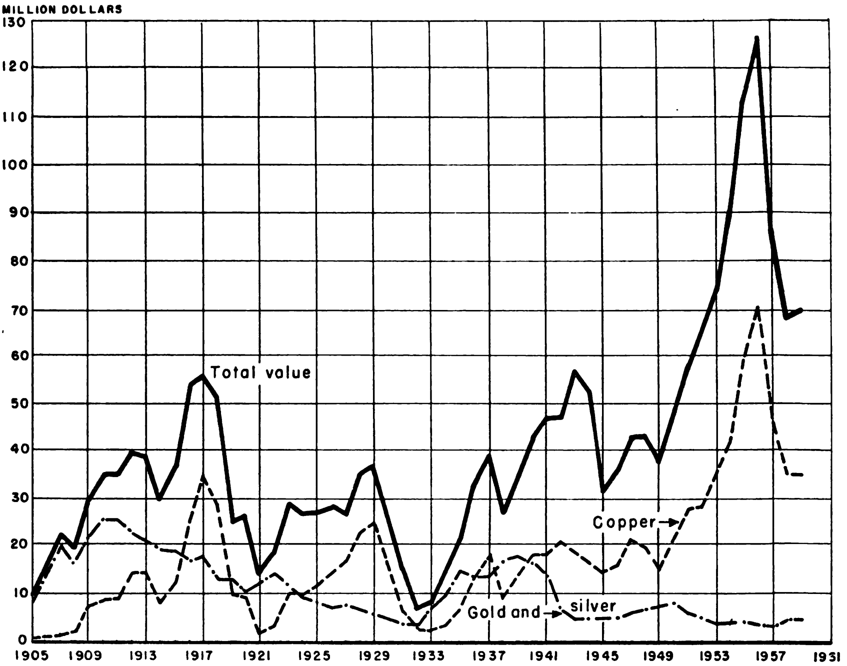

Figure 1.—Value of gold and silver, copper, and total value of mineral production in Nevada, 1905–59.

Legislative and Government Programs.—During March, several chapters and sections of the Nevada State Mining Laws were amended or repealed by the State Legislature. Sections 515.010–515.040, relating to the creation and duties of a mineral-land commissioner office, were repealed. Section 517.240, on filing, contents, and time for recording affidavits and notices to a delinquent co-owner of a mining claim, was amended, extending the time for recording notices and affidavits to 180 days after the notice is given by publication. Section 518.350 was amended, limiting the prohibition against employment of non-English-speaking miners to those who handle explosives. Section 520.110, relating to the right of a stockholder to inspect mining property, was

TABLE 2.—Employment and injuries in the mineral industries [1]

Industry	1958				1959			
	Employees	Injuries			Employees	Injuries		
		Fatal	Nonfatal	Total		Fatal	Nonfatal	Total
Metal mining	3,251	3	138	141	2,977	6	94	100
Nonmetallic mining and quarrying	1,304	1	55	56	1,622	2	45	47
Total	4,555	4	193	197	4,599	8	139	147

[1] Excludes mineral fuels. Collected and compiled by the Federal Bureau of Mines in cooperation with the Nevada State Inspector of Mines.

amended. Chapter 521, Sections 521.010–521.100, inclusive, dealing with oil and gas wells, was repealed in its entirety. The requirement of service of the complaint and summons upon the defendant in the section relating to actions on liens of mechanics was added to Section 108.200. Limitations concerning lands containing mineral or nonmetallic deposits were deleted from Section 111.200. Chapter 362 was amended to allow the county assessor, with approval of the county commissioners, district attorney, and the Tax Commission, to remove from the tax records, names of persons owing taxes on proceeds from unpatented mining claims, if such taxes are uncollectible.

The Nevada State Tax Commission considered arguments against taxation of limestone mined in Clark County based on final use value. The matter was submitted to the attorney general's office for a legal opinion.

Approximately 72 acres of unsurveyed public land near Pioche, Lincoln County (Highland Peak area), was withdrawn from all forms of appropriation, including mining and mineral leasing laws. The public land was used as a remote control, air-to-ground communication facility, serving all types of aircraft. Considerable time might be required by the City of Henderson, Clark County, to clear mining claims from certain areas of the 7,000 acres to be acquired from the Federal Government. Over 2,000 acres of the total are involved.

Four DMEA contracts under the supervision of OME for mineral exploration in Nevada were still in effect at the beginning of 1959. The contract for tungsten in Churchill County was terminated early in the year, leaving three in force at yearend, one each for copper-lead, manganese, and lead-zinc-copper. The 1952 Government purchase contract for minerals produced in Clark County—for manganese nodules from Manganese, Inc., was still in effect at yearend.

Work at the Reno Metallurgy Research Center was largely on the rare and precious metals—the rare earths, principally—with lesser

TABLE 3.—Office of Minerals Exploration contracts active during 1959

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
CHURCHILL					
Tungsten Mountain Mining Co.	Hilltop	Tungsten	Dec. 3, 1957	$32,200	75
ELKO					
John H. Uhalde	Aladdin	Copper-lead	Apr. 29, 1957	62,610	50
LINCOLN					
Southpaw Joint Venture	Southpaw	Manganese	Dec. 27, 1957	12,852	75
WHITE PINE					
Hamilton Corp	Hamilton	Lead-zinc-copper.	June 18, 1958	37,520	50

activity on manganese, the ferroalloy metals and light metals. An important development at Reno was the successful testing of a new method, known as fused-salt-bath electrolysis, on the common tungsten mineral scheelite. Typical scheelite, treated in a one-step operation, yielded molybdenum of 98-percent purity and tungsten of better than 99-percent purity.

At the Boulder City Metallurgy Research Laboratory, studies on the light metals were stressed. but noteworthy work was done on manganese, ferroalloy metals, and rare and precious metals.

Studies of the mechanics of open-pit slopes (and, to a lesser extent, ground pressures) developed in block caving; and other underground operations, in addition to rock-drilling research, comprised the mining-research activity in Nevada during the year.

Work on resources during the year included collecting and disseminating minerals statistics and accident statistics in Nevada, in cooperation with State agencies. Scientific and technologic investigations were conducted on mineral deposits to obtain data on their potential; and at mineral installations to study performance, costs, efficiency, and the effect of geology and rock mechanics on mine design and operation. An economic study on the movements of ferrous scrap material in Nevada neared completion at yearend. The resources group examined and inspected mineral deposits and mining properties and arranged for tests and analyses required in Nevada by the Department of the Interior Office of Minerals Exploration (OME).

Identifying mineral samples submitted by prospectors in California and Nevada continued at the Reno Research Center.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Concentrate recovered from antimony ore mined before 1953 at the Dry Canyon property, Big Creek mining district, Lander County, was shipped to a New York broker for export. The Antimony King mine in the same district was idle throughout 1959, as were the Nye County properties, the Last Chance mine in the Round Mountain district, and the White Caps mine in the Manhattan district. A prospect in the Taylor Canyon area, White Pine County, attracted considerable interest late in the year when an open-pit mining operation and a dry-treatment plant were planned for 1960.

Beryllium.—The Mount Wheeler mine in the Snake Range, about 5 miles south of Wheeler Peak, White Pine County, was the scene of much activity late in 1959. The mine was under stock option to a Utah company, which did extensive exploration work for beryllium ore. This work included nearly 7,000 feet of diamond drilling, 450 feet of drifts, and 200 feet of tunnels and raises. About 1,000 tons of development ore was stockpiled, but the BeO content was not disclosed. Another 1,000 tons of waste was removed from the mine. This mine had been explored in previous years for tungsten, lead, and zinc. The beryllium occurs in a contact metamorphic deposit as the minerals phenacite and bertrandite in silicified limestone.

Copper.—A 13-percent decrease in copper output from 1958 was directly attributed to the prolonged labor strike at domestic base-metal mines, mills, and smelters. A local option by the union at The Anaconda Co. (Lyon County) copper operations allowed production to proceed uninterrupted throughout the year. However, the increased output at this place was more than offset by major declines at the Kennecott Copper Corp. (White Pine County) mine, mill, and smelter; at the Bristol mine, Lincoln County; and at a group of properties in the Battle Mountain mining district, Lander County. In the latter county and district, the properties of Copper Canyon Mining Co. were sold as a unit at auction by Small Business Administration late in the year. Although only 6 lode-mining operations were classified as copper mines in 1959, 18 producing properties contributed to the State total of recoverable copper output. A skip-haulage system was placed in operation at Kennecott Copper Corp. Liberty pit, White Pine County, where over 8 million tons of waste was removed, and 3.5 million tons of ore was mined. During the year, nearly 1,800 feet of exploratory rotary drilling was done at this pit. The producer's smelter at McGill operated on ore from the Liberty and the Veteran pits, as well as on ore previously mined at the Tripp pit. The Anaconda Co. was the leading copper producer in 1959, then Kennecott Copper Corp. and Bristol Silver Mines Co.

Gold.—The total gold output in Nevada rose 8 percent above the previous year. Placer-gold recovery was up 66 percent; this increase

TABLE 4.—Mine production of gold, silver, copper lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1950–54 (average)	176	15	8, 023	119, 510	$4, 183	943, 470	$854
1955	134	10	10, 760	72, 913	2, 552	845, 397	765
1956	132	5	12, 300	68. 040	2, 381	993, 716	899
1957	107	9	11, 770	76. 752	2, 686	958. 477	868
1958	102	14	9, 792	105. 087	3, 678	932, 728	844
1959	67	10	8, 788	113, 443	3, 971	611, 135	553
1904–59 [4]	--------	--------	([5])	15, 054, 906	374, 941	315, 217, 473	216, 264

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	59, 729	$30, 796	6, 152	$1, 835	12, 251	$3, 829	$41, 497
1955	78, 925	58, 878	3, 291	981	2, 670	657	63, 833
1956	80. 824	68, 700	6, 384	2, 005	7, 488	2, 052	76, 037
1957	77, 750	46, 806	5, 979	1, 710	5, 292	1, 228	53, 298
1958	66, 137	34, 788	4, 150	971	91	19	40, 300
1959	57, 375	35, 228	1, 357	312	217	50	40, 114
1904–59 [4]	2, 573. 303	958. 900	388. 872	61, 688	482, 200	93, 211	1, 705, 004

[1] Includes recoverable metal content of gravel, washed (placer operations) or milled; old tailings or slimes retreated; and ore, old tailings, and slag shipped to smelter during calendar year indicated.

[2] Excludes itinerant prospectors, "snipers," "high graders," and others who gave no evidence of legal right to property.

[3] Does not include gravel washed.

[4] From 1904, when first satisfactory annual canvass of mine production was made, to 1959, inclusive.

[5] Data not available.

offset the 28-percent decline in lode-gold production resulting from the costly mine, mill, and smelter strikes, which began in August and ended in December. Of the 10 placer properties reporting production in 1959, only 5 were active during 1958. The Round Mountain dredging operation, Nye County, was the major gold producer and was credited with much of the increased production. Approximately 50 percent of the lode-gold output was recovered as byproduct in processing copper ores mined principally in White Pine County. Slightly more than one-third of the total 1959 recoverable lode gold was derived from gold ores. The Goldacres open-pit gold mine, Lander County, once again was the largest lode gold operation. Two silver mines, the Ohio in Esmeralda County and the Tonopah King in Nye County, and two lead mines, the Diamond-Excelsior and Richmond-Eureka in Eureka County, accounted for 10 percent of the recoverable lode gold (as byproduct); the remaining 3 percent was obtained from all other lode mines in the State.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Clark	1	----------	4	$140	33	$30
Douglas	2	----------	70	2,450	12	11
Elko	6	(2)	5,703	199,605	21,237	19,221
Esmeralda	6	----------	2,433	85,155	178,017	161,114
Eureka	3	2	1,666	58,310	32,343	29,272
Humboldt	5	----------	238	8,330	795	720
Lander	5	1	(3)	(3)	5,194	4,701
Lincoln	4	----------	710	24,850	(3)	(3)
Lyon	2	----------	67	2,345	31	28
Mineral	7	----------	576	20,160	101,024	91,432
Nye	9	3	67,445	2,360,575	77,321	69,979
White Pine	11	----------	(3)	(3)	(3)	(3)
Undistributed [4]	6	4	34,531	1,208,585	195,128	176,600
Total	67	10	113,443	3,970,505	611,135	553,108

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Clark	2,000	$614	1,132,200	$130,203	900	$103	$131,090
Douglas	----------	----------	----------	----------	----------	----------	2,461
Elko	2,800	860	264,700	30,441	82,600	9,499	259,626
Esmeralda	----------	----------	(3)	(3)	----------	----------	246,269
Eureka	(3)	(3)	(3)	(3)	(3)	(3)	87,582
Humboldt	----------	----------	300	34	----------	----------	9,084
Lander	(3)	(3)	23,500	2,702	3,300	379	7,782
Lincoln	(3)	(3)	189,000	21,735	(3)	(3)	46,585
Lyon	(3)	(3)	----------	----------	----------	----------	2,373
Mineral	1,100	338	185,600	21,344	21,800	2,507	135,781
Nye	----------	----------	(3)	(3)	(3)	(3)	2,430,554
White Pine	(3)	(3)	69,300	7,970	15,600	1,794	9,764
Undistributed [4]	114,744,100	35,226,438	849,400	97,681	309,800	35,628	36,744,932
Total	114,750,000	35,228,250	2,714,000	312,110	434,000	49,910	40,113,883

[1] Excludes itinerant prospectors, "snipers," "high graders," and others who gave no evidence of legal right to property.

[2] From property not classified as a mine.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Includes Ormsby, Pershing, Storey, and Washoe Counties combined to avoid disclosing individual company confidential data.

TABLE 6.—Mine production of gold, silver, copper, lead, zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Gold	27	174, 764	16, 679	4, 663	----------	100	----------
Gold-Silver	1	47	12	241	----------	----------	----------
Silver	13	57, 792	3, 689	312, 782	1, 300	6, 000	63, 600
Copper	7	8, 547. 263	23, 858	173, 399	114, 730, 400	72, 100	151, 900
Lead	16	4, 701	1, 939	61 178	12, 700	1, 226, 900	127, 300
Lead-Zinc	4	1, 034	9	21, 106	3, 600	276, 600	90, 100
Total	68	8, 785, 601	46, 186	573, 369	114, 748, 000	1, 581, 700	432, 900
Other "lode" material:							
Gold (slag)	(2)	6	258	211	----------	100	200
Lead residue	(2)	2, 012	----------	30	2, 000	1, 132, 200	900
Total	(2)	2, 018	258	241	2, 000	1, 132, 300	1, 100
Total "lode" material	67	8, 787, 619	46, 444	573, 610	114, 750, 000	2, 714, 000	434, 000
Gravel: (placer operations)	10	(3)	66, 999	37, 525	----------	----------	----------
Total, all sources	77	----------	113, 443	611, 135	114, 750, 000	2, 714, 000	434, 000

[1] Details will not necessarily add to totals, because some mines produce more than one class of material.
[2] From property not classed as a mine.
[3] 1,731,440 cubic yards.

Iron Ore.—Production and shipments of usable iron ore rose 18 percent above 1958 figures, despite the prolonged steel strike during the last half of the year. The increase was attributed primarily to the large tonnage of iron ore concentrate shipped for export. Lower grade ores were mined in 1959, as evidenced by a 10-percent decrease in the tonnage of direct-shipping-grade ore, while the quantity of concentrate produced was 44 percent higher. Beneficiation plants (magnetic separators) were operated at properties in Churchill and Douglas Counties. Production from the Churchill County plant was sold to out-of-State steel plants and for concrete aggregate used in nuclear shielding. The entire output from Douglas County was shipped for

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation and cyanidation:					
Ore	19, 787	305, 358	----------	----------	----------
Concentration and smelting of concentrates:					
Ore	23. 394	117, 171	113, 325, 700	2, 300	1, 300
Direct smelting:					
Ore	3, 005	150, 840	1, 422, 300	1, 579, 400	431, 600
Slag	258	211	----------	100	200
Lead residue	----------	30	2, 000	1, 132, 200	900
Total	3, 263	151, 081	1, 424, 300	2, 711, 700	432, 700
Placer	66, 999	37, 525	----------	----------	----------
Grand total	113, 443	611, 135	114, 750, 000	2, 714, 000	434, 000

export. Except for a Nye County producer who utilized the iron ore as an additive in manufacturing refractories, most of the remaining Nevada production was direct-shipping ore consigned to domestic steel producers. The Modarelli (Simplot lease) deposit in Eureka County was leased from the owner during 1959. Ore was mined and shipped to a Utah producer of dead-burned dolomite.

In Lincoln County several cars of "luppen," a product similar to blast furnace pig iron, was shipped from Pioche to a west coast steel plant. The metal was produced from Wyoming iron-titanium ore processed in a pilot plant at Caselton. Exploration at the Dayton iron deposit, Lyon County, was begun in September and continued at yearend. The Iron King open-pit mine in Humboldt County, a major source of iron ore during the past several years, was converted to underground operation. Some underground ore was mined and shipped. Discovery of an iron ore deposit on a 50-square-mile tract in Pershing County, about 25 miles east of Lovelock, was announced by the owners. Nearly 26,000 feet of drill holes indicated the deposit had a reserve of about 60 million tons of low-grade ore. In the same area, exploratory work by the owners of the Iron Horse group of claims included more than 1,000 feet of diamond drilling. In Sec. 16, T. 25N., R. 34E., Pershing County, exploration and development was reported as 10,000 feet of rotary drilling, 20,000 feet of trenching, and 20,000 cubic yards of stripping. At the Buena Vista operation, Churchill County, the company completed mapping, drill-core logging, cross sectioning, and metallurgical testwork on the drilling program completed in 1958.

Iron and Steel Scrap.—The Reno and Las Vegas areas were the principal dealer centers for Nevada. Reno received scrap from central and northern Nevada; Las Vegas, from southern Nevada, Arizona, and southeast California. San Francisco (Calif.) area consumed the Reno prepared scrap, and Los Angeles area was the principal outlet for Las Vegas dealers. The Naval Ammunition Depot at Hawthorne, Mineral County, was the major source of military scrap sold on open bid; lesser quantities were sold by the Naval Air Station at Fallon, Churchill County; the Stead Air Force Base near Reno, Washoe County; and Nellis Air Force Base near Las Vegas, Clark County. The Anaconda Co. copper leaching plant at Yerington, Lyon County, consumed approximately 40,000 tons of shredded detinned cans during 1959 in producing copper precipitates. This form of steel scrap was shipped into Nevada from Los Angeles, Calif., and Houston, Tex., and represented a very high percentage of the total scrap received from out of State during the year. Some iron and steel scrap was consumed in producing steel castings at the McGill copper smelter, White Pine County.

Lead.—Production of recoverable lead dropped 67 percent from 1958. Over 90 percent of the more than 5.5-million-pound metal decline was reflected in the lower outputs of Eureka County mines as a result of major labor strikes at out-of-State smelters. The largest single Nevada source for lead in 1959 was the byproduct lead residue produced in processing manganese ores in Clark County. This source was 42 percent of the total metal recovered. Ores from 16 lead mines in the State amounted to 45 percent, and the remaining 13 percent was byproduct lead recovered in treating ores from other active lode mines in Nevada. The Richmond-Eureka mine, Eureka County, was the leading lead producer; then, the Delno mine, Elko County, the Diamond-Excelsior, Eureka County, the New Potosi mine, Mineral County, and the LSZ mine, Lincoln County. Output from each of these mines was more than 100,000 pounds of metal.

Considerable exploration and development work was conducted at lead mines throughout the State during 1959. In the Spruce Mountain district of Elko County, drilling, tunnels, and raises accounted for most of the work at the Bulls Head and Parker mines. At the Diamond-Excelsior mine, Eureka County, the company completed 2,000 feet of long-hole drilling and nearly 1,500 feet of drifts, raises, and winzes. In White Pine County, development work included shaft sinking and drifting at the El Dorado lead mine and the Grand Deposit lead-zinc property.

Manganese.—Production and shipments of manganese ore, concentrate, and nodules declined more than 50 percent from 1958, because of termination of the Government (carlot) purchase program August 5, 1959. In Clark County the State's major producer worked the Three Kids (Hulin Pit) mine, and processed the ore in the company concentrating and nodulizing plant. Exploration at the pit during the year included more than 11,000 feet of diamond drilling. The company reported that operations were confined to lower grade ore after the first 3 months of the year, but that sufficient reserves were available to operate profitably through 1960. Another Clark County operator produced synthetic battery-grade manganese dioxide from ore mined in Mexico. Shipments of manganese ore, averaging more than 40 percent of contained manganese, were made to General Services Administration (GSA) from the Hot Spot property, Humboldt County, the Black Devil deposit, Lander County, and the Manganese mine, White Pine County. Ore from the latter was upgraded in Arizona, and the concentrate was shipped to GSA. The same Arizona mill received low-grade manganese ores from this mine, the South Paw property, Lincoln County, and a prospect on the Pershing-Humboldt County line.

Mercury.—Nearly equal tonnages of mercury ores were treated in 1958 and 1959 but the average grade was lower in 1959, thus yielding fewer flasks of metal. Ores from four mines in Humboldt County were the source of 90 percent of the mercury produced in Nevada and 88 percent of the total flasks shipped in 1959. Only four mines, two in Humboldt County and one each in Esmeralda and Nye Counties, yielded more than 100 flasks during the year. Although the Cordero mine near McDermitt, Humboldt County, continued to be the major producing mercury mine in the State, 20 other active mercury properties contributed to the total metal output.

Molybdenum.—Production of molybdenite concentrate in 1959 was limited to the byproduct output from copper ores mined in the Robinson district, White Pine County, and recovered in the producer's nearby concentrator. Lower production, compared with 1958, was due entirely to labor strikes at the base metal operations. The entire output was shipped to an out-of-State consumer.

Silver.—Silver production in Nevada was 34 percent less than in 1958. Although placer-silver output was greater by 66 percent, only

TABLE 8.—Mercury production by methods of recovery

Year	Direct-furnaced		Retorted		Unclassified,[1] 76-pound flasks	Total		Operating mines
	Ore (short tons)	76-pound flasks	Ore (short tons)	76-pound flasks		76-pound flasks	Value [2]	
1950–54 (average)	19,118	2,699	478	66	2	2,767	598,813	11
1955	109,160	15,843	18,126	2,067	12	5,750	1,669,512	33
1956						5,859	1,522,871	51
1957						6,313	1,559,185	45
1958	82,594	12,552	19,361	1,899	41	7,336	1,680,384	35
1959						7,156	1,627,847	20

[1] Includes mercury recovered from miscellaneous dump material.
[2] Value calculated at average price at New York.

6 percent of the State total was of placer origin, and the increase was offset by declines in lode production. Metal recovery from silver ores was nearly twice that in 1958, but byproduct output from copper ores was less than half the 1958 figure, and recovery from lead and lead-zinc ores was only one-fourth that of the previous year. This marked drop in byproduct silver output was caused by the lengthy mine, mill, and smelter strike that greatly curtailed activities at copper, lead, and zinc mines. The combined activities of three mining companies accounted for 73 percent of the State total recoverable lode silver in 1959. They were: United States Milling and Minerals Co., Esmeralda and Nye Counties (silver ores), Kennecott Copper Corp., White Pine County (copper ores), and Argentum Mining Co., Mineral County (silver ores). The Delno mine, Elko County (lead-zinc ore), Richmond-Eureka mine, Eureka County (lead ore), and the Bristol (copper ore) and LSZ (lead ore) mines, Lincoln County, also contributed appreciably to the total silver output.

Titanium.—Production at the Titanium Metals Corp. Henderson plant was reportedly curtailed in July. The industry's marketing readjustment and uncertainty in the basic steel industry were cited as contributory factors in the production cutback. New engineering applications of titanium in astronautics were indications of future improvement in the industry.

Tungsten.—A former major producer of tungsten concentrate in Mineral County, purchased concentrate from two Nevada producers, and from out of State. These purchases and concentrate from company stocks were used in manufacturing tungsten carbide. The Fisk and Quick Tungsten No. 6 claims, Churchill County, and the Sugar Hill and Holliday claims, Pershing County, yielded all the tungsten ore mined in 1959. The Fisk ore was mined during exploration while sinking a 45-foot shaft. Total shipments of tungsten concentrate more than doubled those in 1958, because a former Nye County producer reduced stocks substantially. Development was done at the Hilltop tungsten group a few miles east of Mount Grant, Churchill County. A two-compartment shaft was sunk 170 feet, and more than 200 feet of drift and cross-cuts were completed. The owner began excavation and concrete work for a 100-ton-a-day gravity-flotation plant before year-end.

Uranium.—Uranium ore was shipped to a Utah processing plant from four mines, two in Lander County and one each in Lincoln and Washoe Counties. The tonnage shipped was 76 percent greater than in 1958, and the average grade of ore was 37 percent higher.

Vanadium.—Exploration for vanadium ore by Union Carbide Nuclear Co. in the Fish Creek Range, Nye County, was inactive in 1959.

Zinc.—The total reported recoverable zinc output was appreciably above that of the previous year. The zinc content in the ores shipped over the 2-year period remained substantially the same, but in 1959 some of the ores were consigned to an out-of-State smelter with zinc recovery facilities. The smelter that received ores from the same mines in 1958 slagged off the zinc, and no metal recovery was made. Nearly 93 percent of the zinc production credited to Nevada in 1959 was recovered in the treatment of ores from six mines: The Bristol (copper ore) and Tempiute (silver ore) mines, Lincoln County, the Delno mine (lead-zinc ore), Elko County, the Richmond-Eureka and Diamond-Excelsior mines (lead ores), Eureka County, and the Simon Lead mine (lead ore), Mineral County.

NONMETALS

Barite.—The tonnage of crude barite mined at Nevada deposits rose 64 percent above 1958, and the quantity and value of shipments were also higher. Sales were considerably greater than production figures, and stocks of crude mineral were appreciably reduced at yearend. The State's only grinding plant at Battle Mountain, Lander County, ground crude barite from stockpile for use in well-drilling muds and shipped the finished product to out-of-State company-owned compounding plants. The entire 1959 crude barite production was shipped to California grinding plants, some of which were producer owned.

Brucite and Magnesite.—Nevada production of magnesite and brucite, from deposits in the Gabbs area of Nye County, rose more than 50 percent above the previous year. Although domestic sales of magnesia products from producer plants were adversely affected by the prolonged steel strike during the last half of 1959, an increased export business resulted in total sales exceeding 1958 figures. A high percentage of the total output from the State's two magnesia plants was in the form of refractory materials and products. One operator completed a 500-ton per day flotation plant at midsummer, in which a substantial tonnage of magnesite was treated to produce concentrate for dead burning. At the other plant, a special mix unit was installed during the year that permitted the manufacture of various products to customer specifications.

Clays.—The quantities of clays sold and used from Nevada production dropped 28 percent from 1958. The decline was most apparent in the tonnage of fire clay used in making common building brick. Pits in southern Washoe County were the source of fire clay and miscellaneous clay used by a Reno producer of brick and various other clay products. Fire clay mined at the McDonough deposit east of

Ely, White Pine County, was sold to the nearby McGill copper smelter for use in maintaining and repairing facilities. The Jupiter pit southwest of Weeks, Lyon County, yielded fuller's earth, which was prepared for filter aids and as a filter in animal-feed pellets. Bentonitic clay dug at the New Discovery (White Caps) underground mine near Beatty, Nye County, was processed in California for pharmaceutical use.

Diatomite.—Preparation plants were operated in conjunction with open-pit diatomite mining facilities in Esmeralda, Pershing, and Storey Counties. Crude material from a Churchill County deposit was prepared for use as a mineral filler in the producer's Lyon County plant. In Lincoln County, diatomite from an open-pit mine was crushed before shipment to a Los Angeles, Calif., plant, where the material was processed for use as a soil conditioner. Sales of prepared material increased 3 percent in quantity and 11 percent in value, as the output of filter-grade products rose more than twentyfold over 1958. Although much of the 1959 production was used for fillers, comparatively large tonnages were sold for industrial absorbents, anticaking agents, and as carriers for insecticides and fungicides. Lesser quantities were used in insulation and abrasives and prepared for poultry litter. All shipments were out of State to various domestic and Canadian consumers.

Fluorspar.—A deposit in Lincoln County and two in Nye County yielded the State output of crude fluorspar. Approximately half of the Lincoln County production was metallurgical grade, which was sold to a California steel producer; the remainder was shipped to a Government stockpile. One Nye County operator also mined metallurgical-grade fluorspar for a steel company, and the other produced crude fluorspar for consumption in a producer-owned California cement plant. Some exploration and development was done at two other Nye County deposits and at a Clark County prospect.

Gem Stones.—More petrified wood was collected in Nevada during 1959 than any other gem material, then fluorspar, wonderstone, turquoise, anhydrite, rhyolite, agate, epidote, and cinnabar. The Midas district and Mountain City area, Elko County, yielded a high percentage of the petrified wood. Much of the fluorspar was gathered in the Austin area, Lander County. The source of most of the rhyolite reported by collectors was the Fallon area, Churchill County. The Cortez and Battle Mountain districts, Lander County, and the Lone Mountain area, Esmeralda County, supplied major quantities of turquoise. Anhydrite and epidote were obtained near Carson City, Ormsby County. Cinnabar was mined for gem use near Battle Mountain, Lander County, and agate was found in rather large quantities in the Quinn River area, Humboldt County. Reports of other gem materials collected included fire opal from northwestern Humboldt County, and diatomite and opalite near Mina, Mineral County. A 55-pound opal was reported from a Lyon County mine south of Yerington, along the East Walker River.

Gypsum.—All three Nevada producers of crude gypsum reported increased output as demands for the calcined product and for wallboard, lath, and plaster rose well above 1958. Crude gypsum from the Blue Diamond quarry was processed at a nearby plant. In May all properties and facilities of Blue Diamond Corp. were acquired by Flintkote Co. Another Clark County producer shipped the crude mineral to company-owned plants in California. Late in the year, the operator closed the White Eagle quarry near Henderson and opened the Selenite deposit near Apex. The Empire quarry, Pershing County, supplied crude gypsum for calcined products at the producer's nearby Washoe County plant.

Lime.—Production of quicklime and hydrated lime rose 36 percent in 1959, and sales of quicklime were more than that of 1958. Nevada's major producer, in Clark County, worked quarries at Apex and Sloan and operated kilns at Apex and Henderson and hydrators at Henderson and Sloan. Stone mined at the Apex quarry was high in calcium; that from the Sloan deposit was high in magnesium. Some raw dolomite was shipped from the Sloan deposit to out-of-State foundries and refractory plants. A relatively small tonnage of hydrated lime was produced from limestone quarried near McGill, White Pine County. The product was used by the producer as a reagent at a copper ore concentrator.

Perlite.—Crude-perlite production declined 35 percent, compared with 1958, because of reduced sales to out-of-State customers. Consumption of crude perlite in the State's two expansion plants remained virtually unchanged. Output at the Washoe County plant was used by the producer in manufacturing plasterboard; the Clark County plant sold its production for plaster and concrete aggregate.

Pumice (Volcanic Cinder).—Nearly four times as much cinder was prepared in 1959 as in 1958. All but a relatively small tonnage was consumed as concrete aggregate. Material from the Cinder Cone deposit, Nye County, was prepared for use in building block at the producer's Las Vegas plant. Also in Nye County, the Nevada Highway Department mined volcanic cinder and used the material in maintaining and repairing State roads. A pit near the Carson City Airport yielded cinder, which was prepared for concrete aggregate used locally and in Reno. A producer-contractor near Mina, Mineral County, used volcanic cinder mined locally.

Salt.—Surface-mined solar-evaporated salt was harvested at a dry lakebed in Churchill County on property leased from a California salt company. Production exceeded the 1958 figure, and the entire output was sold to local consumers.

Sand and Gravel.—The State's sand and gravel output rose 17 percent in quantity and 42 percent in value over 1958. The comparatively higher value was attributed to the relatively larger tonnages treated in preparation plants, both fixed and portable. Building sand and gravel was produced in six counties for commercial use, paving sand and/or gravel was prepared commercially in four counties, and appreciable quantities of specialty sands were produced in the Overton area, Clark County. Contractors for the Nevada Highway Department produced and prepared sand and gravel in each of the Nevada counties except Storey. Crews of nine county-road agencies dug sand and gravel for maintaining and repairing county roads. In Churchill and White Pine Counties, the crews of Federal agencies prepared paving and structural sand and gravel, respectively, for their own use. The State's major producers operated fixed plants in the

Las Vegas area, Clark County, and near Reno, Washoe County. Roofing granules produced from a gravel source near Las Vegas were sold locally.

Stone.—Except for limestone quarried to produce lime, stone output was lower than in 1958 by 14 percent. The most noticeable decline was in the quantity of miscellaneous stone quarried in Elko County for use as railroad ballast. The tonnages of basalt and granite produced for riprap, concrete, and roadstone were slightly greater than in the previous year. Declines were noted in the output of marble for terrazzo, and that of marl as a filler in animal feeds and for poultry grit. Sandstone quarried a few miles southwest of Jean, Clark County, was prepared for roofing granules sold in the Las Vegas area.

Sulfur.—The quantity of sulfur ore mined from the only active sulfur deposit in the State, in the Kamma Mountains near Sulphur, Humboldt County, dropped more than 50 percent below the 1958 figure. Shipments were negligible, as the demand for this source of agricultural sulfur was unusually low.

Talc and Soapstone.—Talc and soapstone production in 1959, confined to Esmeralda County deposits, rose 8 percent above the previous year.

TABLE 9.—Sand and gravel sold or used by producers, by classes of operations and uses

	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Glass	(1)	(1)	(1)	(1)
Molding	76,733	$309,131	93,591	$382,251
Building	181,805	224,998	252,194	420,269
Paving	252,777	292,931	146,200	139,314
Fill	----------	----------	45,146	44,742
Other	70,578	130,634	(1)	(1)
Gravel:				
Building	105,262	147,402	415,410	605,108
Paving	837,887	727,254	875,908	724,337
Railroad ballast	----------	----------	1,000	1,250
Fill	----------	----------	67,710	61,643
Other	92,903	156,889	203,735	184,147
Undistributed sand and gravel	44,756	156,148	79,260	240,511
Total sand and gravel	1,662,701	2,145,387	2,180,154	2,803,572
GOVERNMENT-AND-CONTRACTOR OPERATION[2]				
Sand:				
Building	14,700	18,400	30	30
Paving	68,064	33,275	107,034	129,882
Total	82,764	51,675	107,064	129,912
Gravel:				
Building	187,380	267,316	123,275	123,275
Paving	3,569,994	2,846,816	4,025,132	4,465,650
Total	3,757,374	3,114,132	4.148,407	4,588,925
Total sand and gravel	3,840,138	3,165,807	4,255,471	4,718,837
ALL OPERATIONS				
Sand	709,413	1,165,517	723,455	1,356,999
Gravel	4,793,426	4,145,677	5,712,170	6,165,410
Grand total	5,502,839	5,311,194	6,435,625	7,522,409

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes figures for State, counties, municipalities, and other Government agencies.

TABLE 10.—Stone, commercial and Government-and-contractor, sold or used by producers, by uses[1]

Use	1958		1959	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction……short tons..	710	$14,100	(2)	(2)
Rough architectural……cubic feet..	2,230	3,960	769	$1,212
Approximate equivalent……short tons..	174	----------	60	----------
Sawed stone and cut block……cubic feet..	10,807	23,815	[3] 14,551	[3] [4] 47,434
Approximate equivalent……short tons..	843	----------	[3] [4] 1,864	----------
Flagging……cubic feet..	----------	----------	(2)	(2)
Approximate equivalent……short tons..	----------	----------	(2)	----------
Total dimension stone (quantity approximate)……short tons..	1,727	41,875	1,924	48,646
Crushed and broken stone……do….	811,259	1,293,229	838,253	1,538,555
Grand total (quantities approximate) short tons..	812,986	1,335,104	840,177	1,587,201

[1] Includes basalt, granite, limestone, marble, calcareous marl, sandstone, and miscellaneous stone.
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Includes "flagging."
[4] Includes "rough construction" and "flagging."

The total value of the output was 22 percent higher, as better quality minerals were mined. Shipments went to California grinders for ultimate consumption, principally in ceramics, pharmaceuticals, and paints, and for export. Appreciable quantities also were used in insecticides, paper, and rubber.

Water.—Considerable interest was displayed in the possible development of geothermal steam power in the State, and in the subsequent drilling program by a Los Angeles (Calif.) power company. During the year, three wells were drilled at Steamboat Springs, southern Washoe County, with a total footage of over 4,000 feet. The third, and westernmost well, demonstrated a large supply of geothermal steam at good flowing pressures. The company reported that additional drilling west of Well No. 3 might be justified. Three wells also were drilled near Wabauska, Lyon County. One, a rotary well, was drilled below 2,000 feet; the other two, cable-tool wells, were drilled a total of less than 1,000 feet. These wells produced large volumes of artesian water, with flowing temperatures in excess of boiling. No further drilling was contemplated by the company in this area. However, the hot water might be used by a local chemical company in refining sodium sulfate from deposits in the area.

At Brady Hot Springs, Churchill County, between Fernley and Lovelock, 2 cable-tool wells were drilled to a total of 1,031 feet. The first well indicated excellent subsurface temperatures, but lacked permeability. The second well, 500 feet distant, encountered a steam zone at 341 feet, resulting in constant flowing pressure of 45 pounds through an 8-inch pipe. A third well, located 350 feet north of Well No. 2, was to be completed early in 1960. A well was drilled in the geyser area south of Beowawe, Eureka County, to a depth of 1,918 feet. Temperatures were excellent at comparatively shallow depth, but below 400 feet no temperature increase was noted. The well proved to be a reverse fault, and additional drilling was expected to make a substantial thermal discovery; this thermal area is exceeded in extent only by that in Yellowstone National Park.

Wollastonite.—Crude wollastonite obtained from a prospect on the Aladdin mine property near the old town of Bullion, Elko County, was ground and samples were mailed to possible consumers for testing.

MINERAL FUELS

Petroleum.—Two wells of the Eagle Springs oilfield, Nye County, produced in 1959, but production was 20 percent lower than in 1958. There were rumors that extension wells for this 5-year-old field were planned, but no drilling was done in the area. At yearend only one major company (Shell Oil) continued geological exploration in the State. This company abandoned a Clark County wildcat at 5,919 feet early in the year. The well was in the "Bowl of Fire" area, about 28 miles east of Las Vegas. During the year, intermittent drilling was done by independent operators on two wells in Clark County and on one in Churchill County, but no discoveries were made.

REVIEW BY COUNTIES

Churchill.—Iron ore mined in the Buena Vista hills was upgraded by magnetic separation at a nearby plant and shipped for consumption in iron and steel and for use as concrete aggregate in special types of shielding. Total shipments exceeded those in 1958 by 75 percent. Paving sand and gravel was produced and prepared in the Fallon area for use by the U.S. Navy and the Nevada Highway Department. A Fallon contractor produced building and paving sand and gravel for local use. Much of the diatomite mined in the Jessup area was processed in the producer's Lyon County plant, although some crude material was prepared at the mine and sold for poultry litter. High-grade tungsten ore mined in the *Shady Run* district during exploration by shaft sinking, was concentrated by gravity methods and shipped to a Mineral County tungsten-carbide plant. A dry lakebed near Fallon was the source of Nevada's only salt production. The output was consumed locally. A few flasks of mercury were retorted from ore mined at the Red Bird group east of the Humboldt Salt Marsh and sold to Quicksilver Products, Inc.

Clark.—The Three Kids mine and the nearby concentrator and nodulizing plant, accounted for most of the State manganese production. During the first 6 months, considerable drilling was done at the mine adjacent to the regular pit. A new ore body (Hulin pit) was found, which yielded about 81,000 tons of ore after more than one-half million cubic yards of waste had been stripped from the site. During the first 3 months of the year, the plant was operated on stockpiled ore. In the middle of March the company began treating the waste pile, which ran approximately 9.5 percent manganese. A total of 290,000 tons of ore was fed to the mill yielding over 71,000 tons of concentrates from which nearly 50,000 tons of nodules was produced.

The lead residue from the treatment of manganese ores from the Three Kids mine yielded 42 percent of the total recoverable lead cred-

TABLE 11.—Value of mineral production in Nevada, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Churchill	$574,146	$692,482	Iron ore, sand and gravel, diatomite, tungsten, salt, mercury, gem stones.
Clark	12,891,631	12,567,850	Manganese nodules, lime, sand and gravel, gypsum, stone, lead, copper, gold, zinc, silver.
Douglas	1,294,355	1,650,830	Iron ore, sand and gravel, gold, silver.
Elko	953,463	1,251,522	Sand and gravel, gold, barite, stone, lead, silver, zinc, gem stones, copper, mercury.
Esmeralda	879,107	1,140,441	Diatomite, sand and gravel, silver, mercury, gold, talc and soapstone, gem stones, stone, lead.
Eureka	1,306,822	591,023	Sand and gravel, lead, iron ore, gold, silver, stone, zinc, copper.
Humboldt	2,576,970	2,526,087	Mercury, iron ore, sand and gravel, stone, manganese ore, gold, gem stones, sulfur ore, silver, lead.
Lander	1,319,452	928,983	Barite, gold, uranium, sand and gravel, copper, gem stones, silver, manganese ore, lead, antimony, stone, mercury, zinc.
Lincoln	[1] 1,783,966	1,485,140	Sand and gravel, perlite, copper, fluorspar, silver, zinc, gold, lead, stone, diatomite, uranium.
Lyon	14,351,198	19,041,083	Copper, diatomite, sand and gravel, clays, gold, gem stones, silver.
Mineral	187,433	198,457	Silver, barite, sand and gravel, lead, gold, stone, tungsten, zinc, mercury, gem stones, copper, pumice.
Nye	3,204,129	4,851,382	Gold, magnesite, brucite, sand and gravel, fluorspar, tungsten, silver, petroleum, barite, stone, iron ore, mercury, pumice, lead, zinc, clays.
Ormsby	108,022	79,558	Pumice, sand and gravel, gold, gem stones, silver.
Pershing	2,001,029	2,450,598	Iron ore, gypsum, diatomite, sand and gravel, perlite, mercury, gold, tungsten, silver, lead, zinc, stone.
Storey	1,361,046	1,217,450	Diatomite, gold, silver.
Washoe	1,453,839	1,701,303	Sand and gravel, stone, clays, uranium, gold, silver.
White Pine	[1] 21,976,963	17,708,781	Copper, gold, lime, sand and gravel, silver, molybdenum, stone, manganese ore and concentrate, lead, clays, zinc.
Undistributed [2]	[3] 69,229	76,030	
Total	68,293,000	70,159,000	

[1] Excludes value of manganese and low-grade manganese ores sold and blended at Government low-grade stockpiles for future beneficiation.
[2] Includes gem stones and mercury not listed by counties, as data are not available.
[3] Revised figure.

ited to the State in 1959. Some copper, zinc, and silver were also recovered from the residue.

Quick- and hydrated lime were prepared from limestone and dolomite quarried at Apex and Sloan, respectively. The output was consigned principally to industrial consumers in neighboring States. More than 2 million tons of sand and gravel was produced from pits in the county. Nearly 50 percent of the total was for structural and paving use by city, county, State, and Federal agencies. In the Overton area, about one-half million tons of silica sand was produced and prepared for glass, molding, and furnace use and shipped to out-of-State consumers. Crude gypsum quarried at Blue Diamond and near Henderson and Apex was calcined in the producer's plants in Nevada and California. Granite quarried in the southern tip of the county was used by the Bureau of Reclamation in constructing jetties at Needles, Calif. Sandstone quarried near Goodsprings was used in rough construction, and sandstone from the Simon Rainbow quarry at Jean was crushed for roofing granules used in the Las Vegas area. Over 20,000 tons of limestone from nearby quarries was used in the maintenance, repair, and construction of Las Vegas streets.

A fluorspar prospect in the Virgin Mountains, near Bunkerville, was the scene of exploration and development that included 200 feet of drifts and crosscuts, but no fluorspar was shipped. Crude perlite purchased from a Lincoln County producer was expanded in a Las Vegas plant and used for plaster and concrete aggregate.

Douglas.—Iron ore, mined on the Minnesota claims in the northeast corner of the county, was upgraded by the producer with magnetic separators. The entire output was shipped for export. Two contractors in the Minden-Gardnerville area produced and prepared building and paving sand and gravel for commercial use. One of the contractors operated a batch plant at Carson City. Paving sand and gravel was produced by crews of Douglas County and the Nevada Highway Department for their own use.

The Arrowhead (*Wellington* district) and Monarch (*Mount Siegel* district) gold mines were worked by the same operator in 1959 and yielded some gold and silver. Considerable rehabilitation work was done at the Arrowhead, including several hundred feet of drifts and winzes. At the Monarch the work consisted principally of stripping and trenching.

Elko.—Crews and contractors of the Nevada Highway Department produced and prepared nearly 400,000 tons of paving sand and gravel for use in the county. Over 100,000 tons of structural gravel sand was produced by county crews. Structural sand and gravel was produced for commercial use by an Elko contractor.

The Bootstrap mine, Boulder Creek area, was Nevada's second largest lode gold mine and the third largest source of gold in the State during 1959. The Delno mine, *Delno* mining district, was the largest producer of recoverable silver, lead, zinc and copper in the county. Other sources of ores of these metals included the Gold Note in the same area, the Battle Creek group in the *Ruby Valley* mining district, and the Nevada Monarch in the Spruce Mountain area. Near Midas, development and rehabilitation work was conducted at the Miners Gold property and the Dixie Gold mine. Tunnels, drifts and crosscuts were completed. Included were 600 feet of rehabilitated drifts in the former and the tunnel connection with the old Elko Prince mine.

Crude barite, mined at the Rossi property in the *Boulder Creek* district and on the Jenkins Ranch lease north of Carlin, was shipped to California grinding plants. About 675 feet of wagon drilling and considerable trenching was done at the Rossi mine during the year. Basalt was quarried near Elko and used by the Bureau of Indian Affairs in road surfacing.

Esmeralda.—Diatomite quarried and processed at the producer's mine and plant, a few miles east of Basalt, was shipped for use principally as a mineral filler. Crews and contractors for the County of Esmeralda and the Nevada Highway Department produced more than 150,000 tons of paving gravel for use in the county.

The Bruhi mill at Silver Peak operated on silver ores containing recoverable gold, mined at the Mohawk and Nivloc mines, and on material from the Red Robin mine dump, all in the Silver Peak area. Ores produced at the Ohio mine near Goldpoint and the Tonopah King mine, Nye County, were also treated in the mill. A cave-in at the Mohawk mine late in the year forced closure of this property. A shortage of ore during this period idled the mill for about 3 months. Development work conducted at the Mohawk and Ohio mines included shafts, tunnels, drifts, and crosscuts that totaled more than 1,200 feet. About 1,250 feet of old tunnels and crosscuts were rehabilitated at the Tonopah Divide mine, *Divide* district, but no ore was shipped. The Thanksgiving mine in the same district was the source of the county's only recoverable lead, plus a few ounces of gold and silver. Ore from two mercury mines in the Trail Canyon area, the B & B and the Red Rock, yielded metal by retort and furnace that was sold to California buyers.

Nevada's entire talc and soapstone production came from deposits in the Dyer, Lida, and Palmetto areas. The quantity produced exceeded the 1958 figure by only 8 percent, but higher quality material was mined and the value rose 22 percent. More than 2,000 tons of miscellaneous stone was quarried for riprap by a contractor for the Nevada Highway Department.

Eureka.—Nearly 300,000 tons of paving sand and gravel, more than half washed and screened, was produced and prepared by crews and contractors of the County of Eureka and the Nevada Highway Department.

Lead ores mined at the Richmond-Eureka and Diamond-Excelsior mines near Eureka were the principal source of county gold, silver, copper, lead, and zinc production. Stream gravels at the Bulldog and Pepper Gold properties in the *Lynn* mining district were worked to recover placer gold and silver. The Modarelli (Simplot lease) iron mine, in the Cortez Mountains, about 20 miles south of Palisade, was leased from the owner in 1959. The ore produced was consigned to a Utah producer of dead-burned dolomite.

Miscellaneous stone quarried near Palisade by a contractor for the Southern Pacific Co. was used as railroad ballast.

Humboldt.—Ores mined in the county accounted for a high percentage of mercury output in Nevada. The State major producer, the Cordero mine near McDermitt, furnaced ore to produce the metal; ores mined at the Cahill property near Hot Springs Peak, the Shoel deposit 2 miles south of Sulphur, and the McAdoo mine in the *Battle Creek* district, were retorted. The mercury was sold out of State. Development work at the Cordero, Cahill, and McAdoo mines included several hundred feet of drifts, crosscuts, winzes, and raises. Some churn drilling was done at the Cordero, and trenching was done at the McAdoo. A few thousand tons of ore was produced from exploration and development work at the Cahill property.

Direct-shipping-grade iron ore from the Iron King and Red Bird properties in the Jackson Mountains north of Jungo was sold to out-of-State pig iron and steel producers. Late in the year the Iron King mine was converted from open-pit to underground operation. Crews and contractors for the County of Humboldt and the Nevada Highway Department produced and prepared nearly 300,000 tons of paving sand and gravel used in the county. Sawed dimension sandstone from a quarry near Virgin Valley was used for architectural purposes. Miscellaneous stone used for riprap was quarried by a contractor for the Nevada Highway Department.

Manganese ore, mined at the Hot Spot group of claims in the *Poverty Peak* district, was shipped to a Government stockpile under the carlot program. Two lode-gold mines in the *Awakening* mining district were sources of recoverable gold and silver. Ore from the Charleston Hill mine in the *Shon* district yielded some gold, silver, and lead. About 500 tons of development rock was produced at the National mine when 300 feet of caved drifts were reopened and over 300 feet of tunnels and raises completed. Exploration at several gold prospects on the Getchell property in the *Potosi* district, included work on shafts, crosscuts, drifts, and raises.

Lander.—Two barite properties, the Shelton mine in the *Argenta* district and the Mountain Springs deposit several miles south of Battle Mountain, were active during the year. One producer shipped to the company-owned chemical plant at Modesto, Calif.; the other sold to grinders in California and Kansas.

The Goldacres open-pit mine in the *Bullion* district was the largest active lode-gold mine and the second largest lode-gold producer in the State. Gold in ore from the Thomas W. mine at New Pass was recovered with a stampmill and amalgamation plates. The Copper Canyon property near Battle Mountain was the county's only source of recoverable copper and yielded some gold and silver. Ore from a silver property in the same area contained lead and gold. The Galena mine near the Copper Canyon workings was the source of ore containing recoverable gold, silver, lead, and zinc. Development work completed at this mine during the year included nearly 200 feet of drifts and winzes and 50 feet of shaft sinking. Bench gravel was worked by drift methods at the Dahl placers (about 15 miles south of Battle Mountain) to produce gold and silver. Ore mined at the Early Day mine near Austin, Nevada's most consistent uranium ore producer, was shipped to a Utah processing plant. The Low Boy uranium mine a few miles south of the Early Day also yielded uranium ore shipped to the same Utah plant.

Paving sand and gravel was produced for use on State and county roads by crews and contractors for the County of Lander and the Nevada Highway Department. A Reno contractor quarried miscellaneous stone in the county for use as riprap by the Nevada Highway Department.

Ore from the Black Devil manganese deposit near Battle Mountain was shipped to a government stockpile. Antimony concentrate recovered from ore mined before 1953 in the *Big Creek* district was shipped to an eastern broker for export. A few tons of mercury ore mined at the Liquid Metals open-pit mine near Battle Mountain were retorted to recover the metal.

Lincoln.—Nearly 500,000 tons of sand and gravel was produced for the Nevada Highway Department; most was used in rerouting U.S. Highway No. 93 in the northern part of the county. Nearly 90 percent of Nevada's crude perlite production and sales originated from the Hollinger mine, near Pioche, and the Delamar deposit, near Caliente.

Copper ore from the Bristol mine, *Jack Rabbit* district, lead ore from the LSZ mine, *Pioche* district, and silver ore mined in the *Tempiute* district were shipped to the same Utah smelter for recovery of gold, silver, copper, lead, and zinc. Appreciable exploration and development was conducted at the Bristol mine during 1959. Nearly 14,000 feet of long-hole drilling and about 1,700 feet of diamond drilling was accomplished. A 750-foot drift was rehabilitated, and over 1,900 feet of new drifts and raises was completed. The Atlanta mine, *Atlanta* district, yielded 1,600 tons of gold ore containing recoverable gold and silver. A shipment of uranium ore was made from the Blue Bird claims, in the same district, to a processing plant in Utah. This was the first ore shipped from this property since 1955.

Metallurgical-grade fluorspar mined in Tule Valley, near Carp, was shipped to a California steel producer and to a government stockpile. Several thousand tons of miscellaneous stone produced from the Caliente quarry was used as railroad ballast. A relatively small tonnage of diatomite, quarried and crushed at Panaca, was shipped out of State and used as a soil conditioner. The testwork on the Wyoming titaniferous iron ore in the pilot plant at Caselton was completed. Shipments of the luppen product were made to a California consumer. Results of the tests indicated that the work was successful, but the costs per ton were excessive. Manganese ore and maganiferous ore handsorted from the South Paw mine dump near Hiko was shipped to an Arizona mill for upgrading.

Lyon.—The Yerington mine of The Anaconda Co. was the leading source of State copper. The Lorraine group of claims a few miles east of Yerington was the source of development rock from which gold and silver were recovered in an Esmeralda County leaching plant.

Diatomite received from a Churchill County deposit was processed in the producer's plant at Fernley. Building sand and gravel was dug, washed, and screened in the county for use in the producer's Carson City ready-mix concrete plant. Crews and contractors for the Nevada Highway Department produced and prepared paving sand and gravel for use on State roads in the county. Fuller's earth removed from the Jupiter pit near Weeks was shipped to the producer's California plant. Exploration at the Dayton iron deposit, begun in September, was continuing at yearend, and results were reported as inconclusive.

Mineral.—Silver ores mined in the *Candelaria* district at the Northern Belle, Lucky Hill, and Mount Diablo mines yielded much of the recoverable silver credited to Nevada. Antimonial lead ore produced at the New Potosi mine, in the same area, was smelted out of State to recover gold, silver, copper, lead, and zinc. Two thousand tons of gold ore mined from the Goldfield Consolidated property in the *Aurora* district contained recoverable gold and silver.

The Columbus (Noquez) barite mine was worked, and the crude mineral was shipped to the producer's plant at Terminal Island, Calif. The B & L deposit, a new property near Mount Montgomery, was the source of a few tons of crude barite shipped for test purposes. About 21,000 tons of paving sand and gravel was produced and prepared by crews of the Nevada Highway Department for its own use. Marble quarried near Luning was crushed and prepared for terrazzo.

A tungsten carbide plant near Rawhide used tungsten concentrate purchased from Nevada and out-of-State producers and from company stocks that were produced in previous years. Ore mined at the Peterson and Reward properties in the Pilot Mountains near Mina was retorted and yielded a few flasks of mercury which were sold to

Quicksilver Products, Inc. Development at the Reward mine included over 100 feet of raises and crosscuts. Near Mina, Pumco Aggregate produced and used volcanic cinder for concrete aggregate.

Nye.—The placer operation at Round Mountain produced more gold than all other lode and placer sources in the State, combined. This plant was closed from mid-February to mid-April because of weather conditions, and in December the operators announced a shutdown for an indefinite period. Bench and stream gravels worked near Manhattan by drift methods yielded some gold and silver. Although nine lode mines contributed to the State lode-gold output, ores from the Tonopah King, near Tonopah, were the source of a high percentage of the total. Silver production in the county came chiefly from the ores of this mine and the Round Mountain placers. Four lode properties, two in the Willow Springs area, and one each near Gabbs and Manhattan, yielded ores containing recoverable gold, silver, lead, and zinc. Development at the Tonopah King mine included several hundred feet of drifts and raises. At the El Dorado South shaft near the old town of Belmont, 420 feet of shaft was repaired, 600 feet of tunnels rehabilitated, and 260 feet of diamond drilling completed.

Two companies in the Gabbs area mined magnesite and fired the mineral to produce caustic-calcined and refractory magnesias. One of these companies also mined brucite, upgraded it by heavy-media separation, and used the product to make refractories in the producer's Ohio plant. Iron ore mined at the Iron Mountain (Phelps-Stokes) property was utilized by the other magnesite producer in manufacturing refractory materials.

More than 250,000 tons of paving gravel was produced and prepared by crews and contractors for the County of Nye and the Nevada Highway Department for use in the county. In the Beatty area Metallurgical-grade fluorspar mined from the Crowell property was shipped out of State. Crude fluorspar produced at the nearby Gold Spar deposit was used by the producer in a company-owned California cement plant. About 85 feet of crosscutting was done at this mine during 1959 as development. The Nyco group of fluorspar claims in Water Canyon of the Quinn Range was leased during the year. These claims were worked for a short time in 1958 by Wah Chang Corp.

Shipments of tungsten concentrate were made from the stocks of a former producer a few miles north of Gabbs. Crude barite from the Jumbo mine east of Tonopah was sold to a Clark County contractor for concrete aggregate used in shielding and to a California grinding plant. The operator completed 250 feet of long-hole exploratory drilling of the Jumbo property. Crude barite from a new deposit at Summit Creek north of Tonopah also was ground at California plants. About 100 feet of raises and 160 feet of crosscuts were made during an exploration and development program at this property.

Limestone, used in maintaining Federal roads in the Indian Springs-Mercury area, was quarried at a nearby deposit for the Atomic Energy Commission by a contractor. Miscellaneous stone was quarried in the county by an out-of-State contractor for the Nevada Highway Department and used for riprap. A highgrade opalite (silica) deposit, east of U.S. Highway No. 95, between Tonopah and Goldfield, was worked. The material was ground to 200- to 300-mesh and the product was trucked to Las Vegas and shipped by rail to the west coast.

Mercury was retorted from ores of the Horse Canyon mine near Manhattan, an open-pit prospect near Ione, the Jackpot property in the *Lodi* district, and the San Pedro group in the Reese River area. About 1,800 feet of rotary drilling and 3,000 feet of trenching were done at the Horse Canyon property during 1959. At the Van Ness mercury mine near Belmont 108 feet of shaft was sunk, and an underground station was completed. Volcanic cinder mined near Lathrop was trucked to the producer's block plant in Clark County. Cinder also was produced in the same area for use by the Nevada Highway Department. Bentonitic clay from the New Discovery mine near Beatty was shipped to a California processor.

Ormsby.—A comparatively large tonnage of volcanic cinder was produced near Carson City and prepared for use as concrete aggregate, locally and in Washoe County. Crews of the Nevada Highway Department produced and prepared paving sand and gravel for use on State roads in the county. Stream gravel was worked at the Santiago claims near Silver City, and some gold and silver were recovered.

Pershing.—Four operators mined direct-shipping iron ore by open pit in the *Mineral Basin* district and sold to out-of-State producers of pig iron and steel or shipped for export. Another operator mined iron ore and hauled it to a nearby Churchill County plant for upgrading before shipment. Total shipments from deposits in the county were about the same as in 1958.

Gypsum quarried at Empire was converted to calcined products in the producer's adjacent Washoe County plant. The Tunnel Hill open-pit mine west of Lovelock was operated to produce diatomite, which was processed in the company plant at Colado. Plant products were sold for filtering materials, insulation, and mineral filler. Crews and contractors for the county of Pershing and the Nevada Highway Department produced and prepared nearly 300,000 tons of paving sand and gravel for use on roads in the county. Crude perlite mined from the Pearl Hill quarry was crushed and sized in a plant at Kodak before shipment to the producer's Washoe County expansion plant.

About 80 flasks of mercury were retorted from ores produced at five mines and prospects in the Humboldt Range. Rock produced at the Freckles property during exploration and development work yielded more than half the total. Ancient riverbed and stream gravels were worked on the Rainbow and Magic claims and the Thacker lease, in the Willow Creek area, and placer gold and silver were recovered. A few ounces of gold also were recovered from bench gravels in Barber Canyon. Lead ore from the Keystone mine in Mill Canyon contained recoverable gold, silver, lead, and zinc. Gold and silver were obtained from gold ores mines from the Rochester-Jay mine at Rochester, and the Portland Extension mine in the Seven Troughs area. Dump ores at the Silver Reef prospect in the Seven Troughs area were treated to recover silver. Tungsten concentrate produced from high-grade ore, also mined in the Seven Troughs area, was shipped to a tungsten-carbide plant in Mineral County.

Storey.—The Celatom open-pit mine yielded nearly half of the Nevada diatomite production. The crude mineral was processed in the producer's Clark Station plant and shipped to out-of-State consumers. The Tarto mine, between Gold Hill and Silver City, was the county's only active metal mine in 1959. The mined ore contained recoverable gold and silver.

Washoe.—Pits in the Reno area were the source of nearly 1.4 million tons of sand and gravel, approximately half of which was washed and screened for commercial use in building and paving. About half a million tons of paving sand and gravel was utilized by the Nevada Highway Department and the county of Washoe. Trap rock (basalt) quarried near Reno was used by the U.S. Army Ordnance Department for railroad ballast in Lassen County, Calif. Granite produced by a contractor for the Federal Bureau of Public Roads was utilized as a base course in road paving. Marl from the Double Check quarry near Flanigan was prepared for use in poultry and livestock feed. A contractor for the Nevada Highway Department quarried miscellaneous stone for use as riprap. Clays mined from pits near the Geiger grade south of Reno were used in the producer's Reno plant to make various clay products. Calcined gypsum products were made in a plant at Empire from crude gypsum obtained from the producer's nearby Pershing County quarry. The plant also was used to expand perlite received from a quarry in Pershing County, near Lovelock.

Uranium ore from the Red Bluff claim in the Pyramid area was shipped to a Utah processing plant. Previous shipments of uranium ore had been made from this property in 1956. The Sunbeam prospect near Pond Peak in the *Olinghouse* mining district was the source of ore from which a few ounces of gold and silver was recovered. About 130 feet of tunneling was completed at the Big Ledge group, a copper prospect being explored northwest of Reno.

White Pine.—Much of Nevada copper output was obtained from the copper ores mined in the *Robinson* district. The Liberty and Veteran pits were active until the mine, mill, and smelter strike in August. Previously mined ore from the Tripp pit was concentrated and smelted by the producer. These ores were also the source of appreciable quantities of molybdenum concentrate. Clean-up operations at the Mable and Maggie claims yielded material containing recoverable copper and a few ounces of gold and silver. Lead ore from the Eldorado mine in the same district was smelted out of State to recover gold, silver, copper, lead, and zinc. In the Hamilton area, the Great Valley, Hamilton, and Rocco Homestake properties were worked for the same metals. Ores were mined at the Last Chance and Sunnyside mines near Ely for their silver content. Reports on the rehabilitation work at the Belmont mine near Hamilton indicated possible production by mid-1960. The Manganese mine near Ely was worked during the year, and manganese ore was consigned to GSA on the carlot program. Low-grade manganese ore was shipped to an Arizona mill. The operator completed about 200 feet of tunnels at this property during the year in the course of exploration and development work. The Merrimac claims in Taylor Canyon created considerable interest as a source of antimony ore. Plans were made for open-pit mining and a dry-separation plant to be in operation early in 1960. The Mount Wheeler mine, a few miles south of Wheeler Peak, was explored for beryllium ore. Although development rock was stockpiled the BeO content was not revealed.

Lime was prepared from limestone quarried near McGill and used by the producer locally in a copper concentrator and smelter. Crews and contractors of the Nevada Highway Department produced and prepared nearly 100,000 tons of paving sand and gravel for use on State roads in the county. Employees of Lehman Caves National Monument produced a few tons of structural sand and gravel for local use. Dimension quartzite from the Star Dust quarries, near Baker, was sold for rough building stone and flagging. A few tons of miscellaneous stone was quarried for riprap by a Utah contractor for the Nevada Highway Department. Clay mined from a pit a few miles east of Ely was utilized at the nearby McGill copper smelter.

The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the New Hampshire State Planning and Development Commission.

By Joseph Krickich [1] and Mary E. Otte [2]

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MINERAL production in New Hampshire in 1959, valued at more than $4.7 million, set a new record. Accelerated mica mining and improved quality of strategic mica delivered to General Services Administration (GSA) for the national stockpile raised the total value to more than $1 million for the year. Mica, with a 75-percent increase over 1958, accounted for 24 percent of the total mineral value for the State.

Legislation and Government Programs.—The Federal Government, through GSA, continued purchasing strategic mica and beryl for stockpiling. Hand-cobbed and full-trimmed mica produced in New Hampshire was bought by GSA at its Franklin, N.H., and Spruce Pine, N.C., depots, whereas only full-trimmed mica was shipped to the Custer, S. Dak., depot for purchase. Beryl produced in the State was sold only to the New Hampshire depot.

TABLE 1.—Mineral production in New Hampshire [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate……gross weight	14	$8	20	$12
Clays	26,100	26	26,150	26
Gem stones	(2)	5	(2)	10
Mica:				
Sheet……pounds	[3] 81,472	[3] 646	119,163	1,133
Scrap	314	12	(4)	(4)
Peat	100	(4)	25	(4)
Sand and gravel……thousand short tons	4,940	2,620	5,124	2,887
Stone	(4)	(4)	82,141	488
Value of items that cannot be disclosed: Feldspar and values indicated by footnote 4	------------	602	------------	166
Total New Hampshire	------------	[3] 3,919	------------	4,722

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Revised figure.
[4] Figure withheld to avoid disclosing individual company confidential data.

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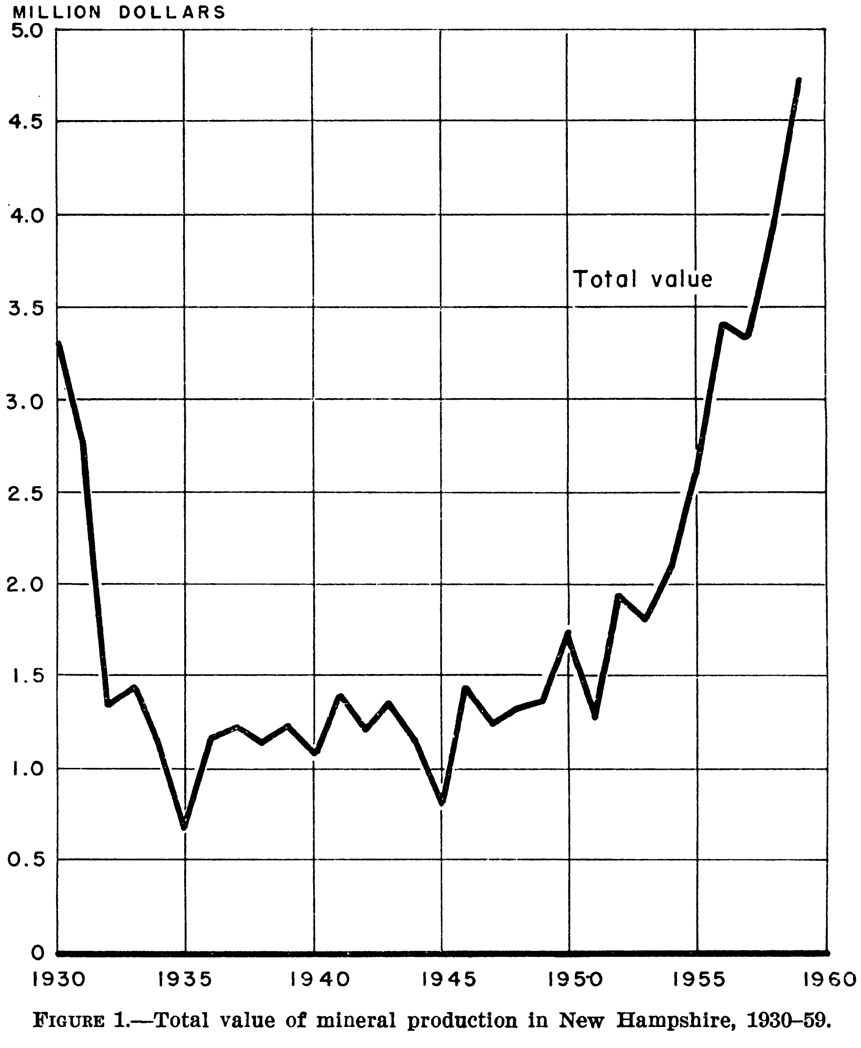

FIGURE 1.—Total value of mineral production in New Hampshire, 1930–59.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of miscellaneous clay was slightly greater than in 1958. The entire output, by two producers in Rockingham County and one in Grafton County, was used in manufacturing building brick.

Feldspar.—Sales of marketable feldspar decreased 26 percent in tonnage and 32 percent in value. Two producers ceased operations; the larger, Whitehall Co., Inc., liquidated its mine operations in New Hampshire. The two active companies operated three mines, producing potash feldspar from two and potash-soda feldspar from the third. Average value of crude ore from these mines decreased approximately $0.35 per ton. Crude ore was used at company grinding plants in Cheshire County. Shipments of ground feldspar increased 40 percent and were more diversified than in 1958, larger tonnages being shipped to the glass industry and for use in enamel and other products. Less ground feldspar was used by the pottery industry than in 1958. The average value for fine-ground, ceramic-grade feldspar was $0.27 higher than in 1958, whereas the value of sandspar (a mixture of quartz and feldspar used in glass making), was much lower. Ground feldspar was shipped principally to Connecticut, New York, Ohio, Massachusetts, and West Virginia.

Gem Stones.—Gem stones and mineral specimens were actively produced or collected by amateur gem collectors mainly in Grafton, Carroll, and Cheshire Counties. The value of gem stones and mineral specimens was double that in 1958. Among the gems and minerals collected in 1959 were beryl, smoky quartz, topaz, mica, and numerous uranium minerals.

Mica.—Sales of sheet mica to the Government and scrap mica to industry showed marked increases, while sales of sheet mica to industry declined. Increases of 46 percent in quantity and 75 percent in value in sales of sheet mica were due primarily to sharp increases in the quantity of hand-cobbed mica and full-trimmed mica sold to GSA purchase depots. The average selling price of hand-cobbed mica to the GSA was $0.30 and of full-trimmed mica, $16.22. Industry purchased limited quantities of punch and washer, half-trimmed and full-trimmed mica at an average price of $0.34. Grafton County supplied 74 percent of the State's sheet mica (including converted hand-cobbed mica) in 1959 compared with 80 percent in 1958. Output of ground mica increased 5 percent in tonnage and 13 percent in value compared with 1958. These increases for wet-ground mica were due to its greater use in rubber and paint. Although small quantities of wet-ground mica were marketed for use in plastics in 1958, none was marketed for this use in 1959.

Peat.—Output of peat decreased. All reed-sedge peat was produced in Belknap County.

Sand and Gravel.—For the fifth consecutive year production and value increased, and sand and gravel continued to be the State's leading mineral commodity. Owing to the continuing roadbuilding program, output of paving sand and gravel by commercial and Government-and-contractor operations increased from 4,380,000 tons in 1958 to 4,497,000 tons in 1959. In addition, 406,000 tons of building sand and gravel was produced, 3 percent more than in 1958. Limited quantities of engine and filter sand, fill, and other sand and gravel also were produced. Seventy-one percent of the commercial and 3 percent of Government-and-contractor production was washed, crushed, sized, or otherwise prepared. Less than 1 percent of the commercial output was shipped by rail; the remainder was delivered by truck. The New Hampshire Department of Public Works and Highways, by far the leading producer, reported production of sand and gravel by their own crews or under contract in all counties of the State. Production of sand and gravel for local highway construction and maintenance was reported by the Manchester Highway Department in Hillsboro County and the Concord Commissioner of Public Works in Merrimack County. Combined commercial and Government-and-contractor tonnage came chiefly from Merrimack and Cheshire Counties.

TABLE 2.—Production of sand, gravel, and stone by Government-and-contractor operations, by counties, in short tons

County	Sand and gravel		Stone	
	1958	1959	1958	1959
Belknap	90,221	139,573	------------	------------
Carroll	334,199	355,693	112	------------
Cheshire	363,572	429,931	------------	------------
Coos	139,998	414,804	3,898	279
Grafton	189,644	289,758	1,590	206
Hillsboro	427,916	307,867	11,501	375
Merrimack	774,046	812,583	4,400	1,914
Rockingham	551,607	267,679	20	------------
Strafford	729,070	205,912	13,076	------------
Sullivan	105,931	160,349	67	8,250
Total	3,706,204	3,384,149	34,664	11,024

Stone.—Value of stone production increased considerably over 1958, despite a sharp drop in the quantity of crushed rock marketed. The increased value was due primarily to greater demand for dimension stone and new production of miscellaneous stone.

Output of crushed granite declined sharply in 1959, mainly because the principal producer discontinued operations in 1958. Crushed granite was marketed as riprap and concrete aggregate. Noncommercial production for granite was reported in Coos, Grafton, Hillsboro, Merrimack, and Sullivan Counties; it consisted entirely of riprap. Both production and value of granite used by the New Hampshire Department of Public Works and Highways decreased 68 percent below 1958.

Output of dimension granite increased over 1958, owing to greater demand for rough-construction building stone. In addition, dimension stone was sold as curbing, flagstone, dressed architectural stone, and dressed construction stone.

Miscellaneous stone was quarried near Portsmouth for the first time and marketed for use as concrete aggregate and riprap. Trusiani Mining Co., Brunswick, Maine, produced white quartz from the core zone of the Beryl Mountain pegmatite in Sullivan County. Output was more than triple that of 1958, because demand increased for its use in terrazzo building blocks.

Rockingham and Merrimack Counties were the leading centers for commercial production, and Sullivan County was the ranking area for Government-and-contractor production.

METALS

Beryllium.—Sales of beryl in New Hampshire increased 43 percent in tonnage and 55 percent in value over 1958; as a result, New Hampshire ranked as the third largest producer of beryllium concentrate in 1959. All sales were made to the GSA purchasing depot at Franklin, N.H., at an average price of $0.29 per pound. The ore ranged from 10.80 to 12.56 percent BeO (beryllium oxide). Strafford County was the center of beryl production; next in decreasing order, were Grafton, Cheshire, and Sullivan Counties.

REVIEW BY COUNTIES

Belknap.—Structural, paving, and fill sand and gravel were produced at the Tilton plant of Tilton Sand & Gravel, Inc. Reed-sedge peat, used as a soil conditioner, was recovered from a bog near Barnstead by Perkins Peat Bog. Full-trim mica was recovered from the Isinglass Brook mine near East Barnstead and sold to the Franklin purchase depot.

Carroll.—A limited quantity of paving sand and gravel was produced near Conway. Mineral specimens and gem-quality stones were collected near Conway, Intervale, and various unspecified locations in the county. Smoky quartz crystals were found in vugs in the pink granite quarry near Conway, and topaz was collected on Baldface Mountain.

Cheshire.—Cheshire County continued to rank second in production of mica. The major part of the hand-cobbed and full-trim mica was sold to the Government through the GSA purchase depot, Franklin, and some through the Spruce Pine, N.C., and Custer, S. Dak., purchase depots. One producer sold punch, half-trim, and full-trim mica to industry. Ten mica mines were operated near Alstead, Gilsum, Marlow, Sullivan, and Alexandria.

TABLE 3.—Value of mineral production in New Hampshire, by counties

County	1958	1959	Minerals produced in 1959 in order of decreasing value
Belknap	(1)	(1)	Sand and gravel, peat, mica.
Carroll	$120,366	$128,579	Sand and gravel, gem stones, stone.
Cheshire	[2] 702,201	848,032	Sand and gravel, mica, feldspar, beryllium, gem stones.
Coos	(1)	153,928	Sand and gravel, stone.
Grafton	[2] 694,141	1,148,080	Mica, sand and gravel, clays, beryllium, stone, gem stones.
Hillsboro	312,538	(1)	Sand and gravel, stone.
Merrimack	(1)	(1)	Sand and gravel, stone, mica.
Rockingham	217,913	(1)	Stone, sand and gravel, clays.
Strafford	(1)	(1)	Sand and gravel, beryllium, mica.
Sullivan	59,965	163,331	Sand and gravel, stone, feldspar, mica, beryllium.
Undistributed [3]	1,812,249	2,279,856	
Total	[2] 3,919,000	4,722,000	

[1] Value included with "Undistributed."
[2] Revised figure.
[3] Includes value of production in counties as indicated by footnote 1 and a quantity unspecified by county.

Despite a decline in tonnage and value in 1959, Cheshire County remained the leading source of feldspar in the State. Golding-Keene Co. recovered crude potash-type feldspar from the Colony mine and crude mixed-type feldspar from the Kidder mine (both near Alstead). The crude feldspar was ground at the company-owned Alstead grinding mill, principally for use in glass, pottery, floor tile, and insulators.

Most of the material was shipped to Connecticut, New York, New Jersey, and Ohio. Foote Mineral Co. ground crude feldspar transported from the Yuhas No. 2 mine in Sullivan County at its plant near North Walpole, chiefly for use in manufacturing pottery and enamel.

Sand and gravel, consisting mainly of prepared material used for building, paving, and fill, was produced by Cold River Sand & Gravel Corp. (North Walpole), and by Keene Sand & Gravel, Inc. (Swanzey).

Production and value of beryl increased considerably as the number of reporting producers increased from one to three. The Osborne, French, and Island mines (all near Alstead) were operated. Among the gem stones and mineral specimens collected in the county were beryl (aquamarine), tourmaline, and quartz.

Coos.—Small quantities of sand and gravel were produced at Gorham, Randolph, and Colebrook.

Grafton.—Grafton County again led in mica output. Sheet mica increased 36 and 71 percent in quantity and value, respectively. Sales and value of scrap mica also increased. All hand-cobbed and full-trim mica was purchased by the Government through GSA purchase depots at Franklin, N.H., Spruce Pine, N.C., and Custer, S. Dak. Thirty-four mica producers were active in the county compared with 39 in 1958. The Keyes, Palermo, and Tarr mines were among the larger producers. Average value of sheet mica sold to the Government increased from $8.73 a pound in 1958 to $10.37 a pound in 1959.

The commercial sand and gravel production reported near Campton and Littleton was used for building and paving. Miscellaneous clay was recovered from an open-pit mine by Densmore Brick Co., Lebanon, and used for making building brick.

Production and sales of beryl to the GSA increased considerably, although the number of producers in the county dropped from seven in 1958 to five in 1959. Output came from mines near Grafton, North Groton, and Wentworth.

Hillsboro.—Commercial sand and gravel, used chiefly for structural and paving purposes, was produced by operators near Manchester and Peterborough. Kitledge Granite Corp. quarried dimension granite near Milford and sold the stone for use as rough structural material.

Merrimack.—The county continued to be the leading sand and gravel producing area in the State. Manchester Sand, Gravel & Cement Co., Inc., and Frank Palazzi & Sons, Inc., prepared building and paving material. The John Swenson Granite Co., Inc., Concord, quarried dimension granite principally for dressed architectural stone and curbing. The company also produced crushed granite for use as riprap, concrete aggregate, and roadstone.

Wilbur L. Brownell (Danbury), Anthony Turchin (Wilmot), and Eastern Mineral, Inc., produced and sold sheet mica to the GSA. Concord Mica Corp. (Concord) ground domestic and imported mica for use in making paint, rubber (mold lubricant), and wallpaper. The Government, through the GSA Franklin purchase depot bought hand-cobbed and full-trim mica, also beryl, under its strategic material stockpiling program.

Rockingham.—Iafolla Crushed Stone Co., Portsmouth, quarried and crushed miscellaneous stone for use as riprap and concrete aggregate. Bank-run sand and gravel was produced near Exeter, chiefly for fill. Both production and value of clay dropped 8 percent compared with 1958. W. S. Goodrich, Inc. (Epping), and Eno Bros. Brick Co. (Exeter) mined miscellaneous clay for use in manufacturing building brick.

Strafford.—Building sand and gravel and fill gravel were produced near Dover and Durham. William Richardson recovered beryl from the Cilley mine near Center Strafford, but output was less in quantity and value than in 1958. Hand-cobbed and full-trim mica was also recovered from the Cilley mine by William Pechnik and William Richardson.

Sullivan.—Bank-run paving sand and gravel was produced near Grantham by Blue Mountain Construction Co. Quartz, produced at the Beryl Mountain mine near South Acworth by Trusiani Mining Co., was crushed and sold for making terrazzo building blocks. Output increased considerably in both tonnage and value. Foote Mineral Co. mined a limited quantity of crude feldspar at the Yuhas No. 2 mine near South Acworth. The material was shipped to the company-owned grinding mill at North Walpole in Cheshire County for processing. Hand-cobbed and full-trim mica was recovered by four operators from the Ledge Pond mine and Sargent mine, all near Sunapee. Constance M. Fitch and Arthur O. Trusiani operated the Beryl Mountain mine near Acworth at different intervals during the year and sold the recovered beryl to the Government.

The Mineral Industry of New Jersey

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the New Jersey Division of Planning and Development, Bureau of Geology and Topography.

By Joseph Krickich [1] and Stanley A. Feitler [1]

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INCREASED production and shipments of iron ore, sand and gravel, and stone highlighted the mineral industry of New Jersey in 1959. Total value increased $9.1 million over that of 1958. Value increases were recorded for all commodities except clays and lime.

Trends and Development.—Recent discoveries may add to the list of mineral commodities mined in the State. Interest in the titanium-bearing sand in Ocean and Burlington Counties continued, with three companies holding land. Radioactive rare-earth minerals were found associated with the magnetite (iron) ore and adjacent pegmatite at the Scrub Oaks Mine operated by Alan Wood Steel Co., near Dover, Morris County. Uranium, thorium, and rare-earth elements were found to be potential byproducts of iron in the coarse-grained magnetite ore. The deposit was studied and described by the Federal Geological Survey in Bulletin 1082–B, 1959.

Expansion of facilities for refining and treating mineral commodities continued. Wah Chang Corp. began constructing a plant at Fairlawn, Bergen County, for producing metallic tungsten and molybdenum. Ground was broken during the year for a new gypsum calcining plant and bulk ship-unloading facilities at Edgewater by Allied Chemical Corp. Air Products, Inc., Iselin, began constructing a plant for commercial production of liquid helium and hydrogen. Phelps Dodge Copper Products Corp. began operations at its new copper-tube mill in Middlesex County. This highly automated plant was reported to be the largest copper-tube mill in the United States. Production of sulfuric acid began during the year at the Paulsboro (Gloucester County) plant of Dixon Chemical Industries, Inc.

Important research facilities and programs involving mineral commodities were noteworthy. Air Reduction Co., Inc., began to build a laboratory in Franklin Township, Gloucester County, to supplement facilities at its central research laboratories at Murray Hill, Union County. The new laboratory was planned for research on fuels and oxidizers with space and equipment for bench- and pilot-scale testing. Astrometals Corp., Hawthorne, continued research with molybdenum, beryllium, and other metals for application to space devices. A large research laboratory was completed during the year by Englehard Industries. The facility had accommodations for research on the platinum-group metals, uranium, quartz, high-temperature metals, ceramics, industrial diamonds, electronics, and ways to reduce air pollution. A new multimillion-dollar research laboratory at Florham Park, Morris County, was dedicated by Esso Research and Engineering Co. The installation will be devoted initially to oil and refinery research. National Beryllia Corp., North Bergen, Hudson County, continued research and development of beryllium oxide ceramics for electronic and other uses. High-purity gold was produced for research and special electronic applications at the central research laboratories of American Smelting and Refining Co., Plainfield.

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REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—A 6-percent decrease in fire-clay output was more than offset by a 4-percent increase in miscellaneous clay production, resulting in larger total clay output than in 1958. Miscellaneous clay comprised 82 percent of the total output and was used mainly for manufacturing building brick, other heavy clay products, and lightweight aggregate. Fire clay mined in Middlesex and Cumberland Counties was used mainly for refractories, heavy clay products, and as a filler. Other uses were in manufacturing architectural terra cotta, pottery

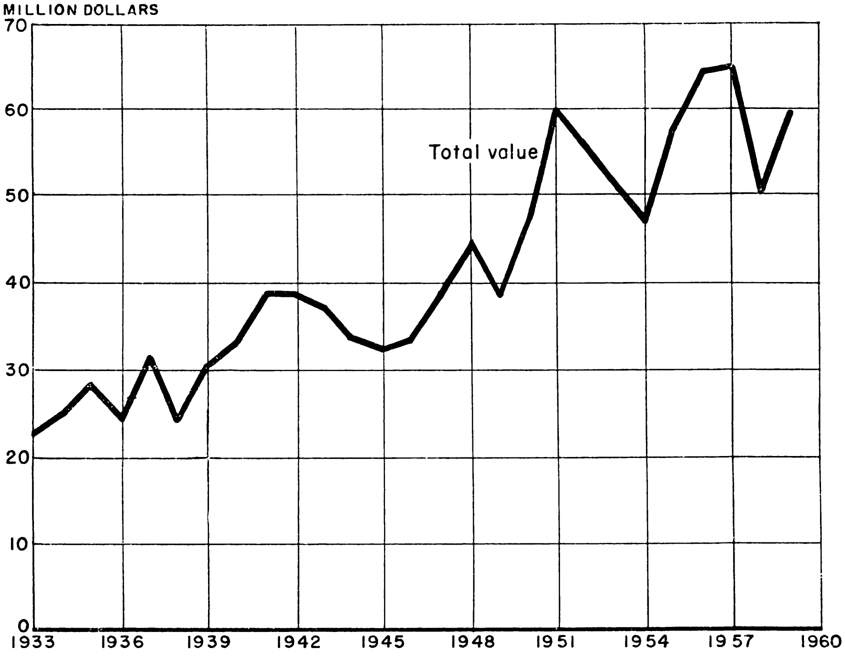

FIGURE 1.—Total value of mineral production in New Jersey, 1933–59.

TABLE 1.—Mineral production in New Jersey[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays	684,306	$2,181	700,286	$1,895
Gem stones	(2)	4	(2)	6
Peat	18,397	185	28,300	278
Sand and gravel .... thousand short tons	9,877	16,145	11,033	18,620
Stone .... do	8,229	19,193	10,079	22,133
Zinc (recoverable content of ore, etc.)[3]	607	125		
Value of items that cannot be disclosed: Iron ore, lime, manganiferous residuum, magnesium compounds, and marl (greensand). Excludes limestone used in manufacturing lime		12,547		16,547
Total, New Jersey		50,380		59,479

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Quantity not recorded.

[3] Recoverable zinc valued at yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to value of ore at mine.

and stoneware, floor and wall tile, and artificial abrasives, and in rotary-drilling mud. Twenty open-pit clay operations in eight counties were active. Middlesex, Somerset, and Burlington, in decreasing order of output, were the leading clay-producing counties. Employment at clay operations totaled 576 men, working 1,087,000 man-hours in 1959. Thirty nonfatal injuries were recorded for the year. The American Vitrified Products Co., of Cleveland, Ohio, announced plans to construct a $4 million plant for manufacturing vitrified pipe and kindred products at Sommerville, Somerset County.

Gem Stones.—Traprock quarries of New Jersey and old mine dumps at Franklin, Sussex County, continued to attract thousands of amateur mineral and gem collectors, who succeeded in adding to their collections during the year. Calcite, franklinite, willemite, zincite, and various other mineral specimens were collected, chiefly from Sussex County. Collectors also reported recoveries in Hunterdon, Somerset, and Warren Counties.

Gypsum.—Two companies at plants in Bergen, Burlington, and Essex Counties processed crude gypsum obtained from other States into finished building products. These products included plaster, lath, sheathing, and wallboard. A new gypsum calcining plant and bulk ship-unloading facilities were under construction adjacent to the gypsum board plant of Barrett Division, Allied Chemical Corp., Edgewater, Bergen County. The new facilities would permit direct unloading of gypsum rock from deep-draft ships at 900 tons per hour and calcining in a fully automated plant.

Lime.—Production and value of lime produced in the State remained about the same as in 1958. Hydrated lime was sold for building, chemical, industrial, and agricultural purposes. Lime was produced in Somerset and Sussex Counties.

Magnesium Compounds.—Output and value of refractory magnesia produced in New Jersey increased substantially, compared with 1958. The average value of refractory magnesia produced in Cape May

County from purchased dolomite and raw sea water increased over $1.50 per ton. Various refined magnesium compounds were produced in Warren County from purchased magnesium-bearing chemicals.

Marl, Greensand.—Greensand marl was produced in Burlington and Gloucester Counties for use as a fertilizer, water softener, and for other purposes. Production and value increased slightly over 1958.

Perlite.—Plants in Middlesex, Passaic, Somerset, and Union Counties expanded perlite from crude material shipped from Southwestern United States. Chief uses for the processed perlite were as building plaster and concrete aggregate, filler, and soil conditioner.

Pigments.—Plants in Essex, Mercer, and Middlesex Counties manufactured various iron oxide pigments. Titanium dioxide pigments were produced at plants in Camden and Middlesex Counties. Manufacturers of zinc pigment were active in Bergen, Hudson, Middlesex, Somerset, and Union Counties. Lead pigments (white lead, red lead, and litharge) were manufactured in Middlesex County.

Roofing Granules.—Roofing granule production increased from 151,000 tons in 1958 to 178,000 tons in 1959; value increased 21 percent and totaled $2.8 million. Natural and artificially colored roofing granules were produced at plants in Bergen, Passaic, and Somerset Counties. Basalt (traprock) quarried in the State was the chief raw material consumed at these plants.

Sand and Gravel.—Compared with 1958, output of sand and gravel increased 1.2 million tons and more than $2.5 million, reflecting increased activity in the construction industry. The increased output was due mainly to an 18-percent increase in production of both building and paving sand and gravel. Sand was sold for 10 major uses, of which only fill sand declined in sales. Sales for all other uses, primarily molding and glass sand, increased over 1958. Production and value of ground sand increased. Ground sand was produced mainly for foundry and filler uses; other uses were in manufacturing abrasives, glass, pottery, porcelain, and tile. Output of paving sand and gravel by Government-and-contractor operations in Atlantic, Camden, and Salem Counties increased.

Commercial production of sand and gravel was reported in 15 counties, 1 less than in 1958. Cumberland County accounted for 20 percent of the total State tonnage and 38 percent of the value. Other leading counties, in decreasing order, were: Morris, Ocean, and Burlington. Eighty-nine percent of the sand and gravel produced was washed, crushed, screened, or otherwise prepared, compared with 88 percent in 1958. Of the total commercial sand and gravel tonnage, 82 percent was transported by truck, 15 percent by rail, and 3 percent by water. Production employees at the 81 commercial sand and gravel plants totaled 979 and worked 2,036,000 man-hours in 1959.

Stone.—Stone production increased 1.8 million tons over 1958 chiefly because of increased demand for basalt, granite, and miscellaneous stone used for concrete aggregate and roadstone. Limestone, marble, and oystershell also were quarried and crushed during the year. Crushed basalt (traprock), which comprised 87 percent of the total stone production, was the principal stone quarried and was used for riprap, concrete aggregate, roadstone, railroad ballast, and other uses. Somerset and Passaic Counties were the leading basalt-producing

TABLE 2.—Sand and gravel sold or used by producers, by classes of operation and uses

Uses	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Sand:				
Structural	2,969	$2,919	3,489	$3,517
Paving	1,590	1,439	2,108	1,923
Fill	347	105	137	74
Glass	531	2,059	604	2,377
Molding	1,264	3,645	1,313	3,866
Blast	122	527	126	521
Engine	(1)	(1)	20	62
Filtration	54	138	56	146
Other [2]	474	1,613	432	1,672
Gravel:				
Structural	1,409	2,497	1,742	3,215
Paving	840	984	768	1,055
Fill	160	95	67	32
Other	64	98	100	129
Total	9,824	16,119	10,962	18,589
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving	10	4	11	4
Other	----------	----------	5	2
Gravel:				
Paving	43	22	50	23
Other	----------	----------	5	2
Total	53	26	71	31
Grand total	9,877	16,145	11,033	18,620

[1] Included with "other sand" to avoid disclosing individual company confidential data.
[2] Includes ground, fire or furnace, and other sand and those uses indicated by footnote 1.

counties. Granite, used exclusively for concrete aggregate and roadstone, was produced in Morris and Hunterdon Counties. Quantities of miscellaneous stone were used for rough construction. Oystershell, used mainly for poultry grit, was recovered and crushed in Gloucester and Cumberland Counties. Marble, used entirely for terrazzo, was produced in Warren County. Limestone was quarried in Sussex and Somerset Counties and was used mainly for agstone, lime manufacturing, concrete aggregate, and roadstone. In 1959, 89 percent of the State total stone output was used as concrete aggregate and roadstone. Somerset and Passaic Counties accounted for 73 percent of the total output and continued as the leading stone-producing counties. Employment at stone quarries totaled 889 men working 1,864,000 man-hours during the year. Seventy nonfatal injuries were reported for the year.

Sulfur.—Production and recovery of byproduct sulfur at petroleum refineries and other plants increased over 1958. Output in 1959 totaled 34,000 long tons valued at $846,000 and was reported from plants in Gloucester, Middlesex, and Union Counties. During the year the newly constructed $5 million sulfuric acid plant at Paulsboro (Gloucester County), of Dixon Chemical Industries, Inc., went into operation. The facility, with an annual capacity of 300,000 tons of acid, utilized sulfur imported mainly from Mexico.

Vermiculite.—Exfoliated vermiculite, used primarily in insulation and as concrete and plaster aggregate, was produced at plants in Essex, and Mercer Counties.

METALS

Base Metals.—Federated Metals Division of American Smelting & Refining Co. refined primary and scrap metals to produce aluminum and magnesium alloys, copper base alloys, and lead products at Perth Amboy. White-metal alloys, zinc die cast, zinc, and zinc dust were produced at the Trenton and Newark plants of Federated Metals Division. The Carteret smelter of United States Metals Refining Co., a subsidiary of The American Metal Co., Ltd., smelted and refined copper and precious-metal-bearing materials. Copper cathodes and furnace shapes were produced from secondary metals at the Perth Amboy plant of International Smelting and Refining Co., a subsidiary of The Anaconda Co. The State's only zinc mine was idle.

Ferroalloys.—Output of ferroalloys increased substantially. Ferroalloys of columbium, titanium, vanadium, tantalum-columbium, molybdenum, and boron were shipped during the year.

Iron and Steel.—Two companies produced steel during 1959. One plant, in Burlington County, operated nine open-hearth furnaces with an annual capacity of 235,000 tons. The other plant, in Essex County, used six electric furnaces with a total annual capacity of 7,800 tons.

Iron and Steel Scrap.—Dealers in iron and steel scrap continued to operate at a fair tonnage level during the year despite the prolonged steel strike. Increased demand by foreign consumers, as well as domestic foundries and steel plants not involved in the strike, prevented market stagnation. Most of the tonnage shipped was composed of Nos. 1 and 2 heavy melting, No. 2 bundles, and cast iron. The principal dealer activity was in the industrial northeastern part of the State.

Iron Ore.—Two mines operating in Morris County and one in Warren County produced 23 percent more crude iron ore than in 1958. Use of shrinkage and sublevel stoping methods resulted in an average productivity rate of 16 tons per man-shift underground. Some direct-shipping (lump) ore was recovered, but most ore was concentrated by wet and dry magnetic separation after grinding. Most of the usable (beneficiated) iron ore shipped was consumed in manufacturing pig iron and steel. A small quantity of the concentrate was converted to high-purity iron powder by direct reduction for use in powder metallurgy.

Rare-Earth Metals.—Concentrates of rare-earth minerals of domestic and foreign origin were processed in Bergen, Essex, and Passaic Counties. Separated rare-earth metals, misch metal, ferroalloys, and other compounds were produced. Research continued on projects to improve processing methods and to find new uses for rare-earth metals.

Rare Metals.—Federated Metals Division of American Smelting & Refining Co., Perth Amboy, increased its capacity to produce high-purity (99.999 percent) indium. Increasing demand for use in electronic applications necessitated a move to larger quarters from the company Central Research Laboratories in South Plainfield. High Purity Metals, Inc., Hackensack, produced indium metal in three grades of purity in 10- and 100-troy-ounce ingots. American Metal Climax, Inc., completed plans to build a plant to refine germanium at Carteret. Plans provided for producing germanium dioxide from primary raw materials and scrap and germanium metal from the oxide.

Titanium.—Tracts of land containing titanium-bearing sand deposits (chiefly ilmenite) were held by three companies in Ocean and Burlington Counties. American Cyanamid Co. owned acreage in Burlington and Ocean Counties. American Smelting & Refining Co. acquired acreage in Manchester and Berkeley Township and in Lakehurst, Ocean County. The Glidden Co. owned ilmenite-bearing land in Jackson Township and began pilot-plant operations to test recovery methods and further sample the sand for heavy mineral yields.

Tungsten and Molybdenum.—A new plant for processing tungsten and molybdenum was being constructed by Wah Chang Corp. at Fairlawn. The new installation was designed to produce both tungsten and molybdenum metals as powder, rod, sheet, or wire in a range of sizes.

MINERAL FUELS

Coke and Coal Chemicals.—Coke and byproduct-coal chemicals were produced at merchant-coke plants in Hudson and Camden Counties. Annual capacity at the plants totaled 1.1 million tons of coke. Byproduct coal chemicals recovered at the plants included ammonium sulfate, monoammonium phosphate, crude coal tar, crude light oil, intermediate light oil, and naphthalene (under 74° C.). The total number of men employed at the coke plants was 525 men working 1.2 million man-hours. Twenty-four nonfatal injuries (all at one plant) were reported.

Peat.—Output and value of peat used as a soil conditioner increased substantially, compared with 1958. Production of moss and humus peat in Somerset County and reed-sedge peat in Sussex County was reported for the year.

TABLE 3.—Capacities of petroleum refineries and cracking plants Jan. 1, 1959, barrels per day

Company	Location	Type of plant [1]	Crude-oil capacity		Cracked-gasoline capacity	
			Operating	Shutdown	Operating	Shutdown
	Gloucester County:					
Mobil Oil Co.	Paulsboro	Complete	87,000	----------	25,400	----------
Texaco, Inc.	Westville	S-C	70,000	----------	24,500	5,000
	Middlesex County:					
California Oil Co.	Perth Amboy	S-C-A	100,000	15,500	19,000	200
Hess Trading & Transport, Inc.	Sewaren	S-C	45,000	----------	8,000	----------
	Union County:					
Esso Standard Oil Co.	Bayonne	S-A-L	25,000	----------	----------	----------
Do.	Linden	Complete	164,000	----------	51,600	[2] 18,030
Cities Service Oil Co. (Pennsylvania).	Linden	S-A	15,000	----------	----------	----------
Total	----------	----------	506,000	15,500	128,500	23,230

[1] Type of plant: A—Asphalt, C—Cracking, L—Lube, and S—Skimming.
[2] Includes 12,000 bbl. daily, considered inoperable.

Petroleum.—Seven petroleum refineries were active during the year, compared with six in 1958. Operating crude-oil capacity at the plants increased from 396,500 barrels per day in 1958 to 506,000; operating cracked-gasoline capacity increased from 124,700 barrels per day to 128,500.

REVIEW BY COUNTIES

Value increases were recorded in all but one of the 20 mineral-producing counties. Morris County had the highest increase ($3.5 million) primarily because of increased shipments of usable iron ore. Peat was added to the list of minerals recovered in Somerset County.

Atlantic.—Commercial output of sand and gravel increased from 82,000 tons in 1958 to 118,000 tons in 1959. Output, chiefly building and molding sand, was reported from operations near Cedar Lake, Folsom, Hammonton, Mays Landing, and Newtonville. Eighty-eight percent of the commercial output was shipped by truck and the remainder by rail. Crews of the Atlantic County Road Department produced paving sand and gravel.

Bergen.—Production of sand and gravel, used chiefly for building and paving purposes, increased over the previous year. The county ranked fourth in value of sand and gravel produced, compared with fifth in 1958. Output was reported from four operations at Mahwah, Paramus, Ramsey, and Wyckoff. Miscellaneous clay used in manufacturing building brick was recovered from a pit near Carlstadt by Tri-County Brick Corp. Barrett Division, Allied Chemical Corp. produced finished gypsum building products at its Shadyside plant, Edgewater. Flintkote Co., East Rutherford, produced artificially colored roofing granules. Rare-earth metals, misch metal, and other rare-earth-metal alloys were produced by General Cerium Corp., Edgewater. Zinc oxide and leaded zinc oxide pigments were produced by Royce Chemical Co. at Carlton Hill.

Burlington.—Sand and gravel, used mostly for building and paving purposes, was recovered at six operations—two each near Riverside and Mount Holly and one each near Burlington and Cinnaminson. Output totaled more than 1 million tons in 1959. Limited quantities of molding and other sand also were produced. National Soil Conservation, Inc., Medford, produced greensand marl for use as a natural fertilizer. Church Brick Co. manufactured building brick from miscellaneous clay produced near Fieldsboro. During the year the company built a new clay storage building, rebuilt its dryers, added a new shovel in the pit, and installed a new apron feeder and a new disintegrator. National Gypsum Co. calcined crude gypsum and manufactured finished building materials at its Burlington plant. John A. Roebling's Sons Corp., a subsidiary of Colorado Fuel & Iron Corp., made open-hearth steel for wire and specialties, cold-rolled products, wire rope, and bridge products at its Trenton plant.

Camden.—Commercial sand and gravel production was centered near Berlin, Grenloch, Pennsauken Township, and Winslow. Output consisted chiefly of molding and other industrial sand and structural and paving material. Construction and maintenance crews of the Camden County Highway Department produced bank-run sand and gravel.

TABLE 4.—Value of mineral production in New Jersey, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Atlantic	$153,955	$183,629	Sand and gravel.
Bergen	962,532	1,307,403	Sand and gravel, clays.
Burlington	1,076,417	1,140,883	Sand and gravel, greensand marl, clays.
Camden	971,880	1,091,670	Sand and gravel, clays.
Cape May	(2)	(2)	Magnesium compounds, sand and gravel.
Cumberland	6,753,085	7,243,863	Sand and gravel, clays, stone.
Essex	(2)	(2)	Stone.
Gloucester	444,874	578,500	Sand and gravel, greensand marl, stone.
Hunterdon	591,469	(2)	Stone, gem stones.
Mercer	1,004,618	(2)	Stone.
Middlesex	2,688,922	2,391,801	Clays, sand and gravel.
Monmouth	793,675	770,306	Sand and gravel.
Morris	9,978,977	13,495,987	Iron ore, sand and gravel, stone, clays.
Ocean	1,057,404	1,713,131	Sand and gravel.
Passaic	6,037,166	6,671,071	Stone, sand and gravel, clays.
Salem	2,866	11,650	Sand and gravel.
Somerset	8,078,228	9,760,060	Stone, clays, peat, lime, gem stones.
Sussex	3,451,592	3,544,025	Stone, manganiferous residuum, lime, peat, sand and gravel, gem stones.
Union	(2)	(2)	Stone.
Warren	(2)	(2)	Iron ore, sand and gravel, stone, gem stones.
Undistributed [3]	6,332,504	9,574,701	
Total	50,380,000	59,479,000	

[1] No production reported in Hudson County.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Includes counties indicated by footnote 2 and a quantity unspecified by county.

Ninety-two percent of the commercial output was prepared material. The New Jersey Division of Alliance Clay Product Co. manufactured building brick from miscellaneous clay produced near Winslow Junction. Coke and byproduct-coal chemicals were produced at the Camden coke plant of Public Service Electric & Gas Co. The company operated 111 Koppers-Becker slot-type ovens with an annual capacity of 400,000 tons. Titanium dioxide pigments were produced at the Gloucester City plant of New Jersey Zinc Co. Construction of additional facilities to increase capacity continued at the plant.

Cape May.—Refractory magnesia was made from raw sea water and purchased dolomite at the Cape May plant of Northwest Magnesite Co. Prepared sand and gravel, used for building material, was produced at operations near Cape May Court House and Tuckahoe.

Cumberland.—Sand and gravel output totaled 2,172,000 tons, a 4-percent increase over 1958. In addition, the county continued to be the leading sand and gravel producing area in the State; 14 operations were active during the year—mostly near Vineland, Millville, and along the Maurice River. Most of the output was prepared material, used mainly for manufacturing glass and as molding sand. In addition blast, fire, filter, and engine sand, as well as building, paving, and other sand and gravel were produced. Ground sand was produced by National Glass Sand Corp. and Pennsylvania Glass Sand Corp., both of Millville. Production employees at the plants totaled 416 working 890,000 man-hours during the year. County output was shipped by rail and truck (50 percent each). Daniel Goff Co. Inc. (Millville) produced plastic fire clay as a binder for foundry sand. William Edge produced a small quantity of ground oystershell, used exclusively as poultry grit, at a crushing plant near Dorchester. Owing to a short supply of oystershell, the plant was operated only 3 months during the year.

Essex.—Crushed basalt was quarried near West Orange and South Orange for use mainly as concrete aggregate and roadstone. E. I. duPont de Nemours & Co. Inc., Newark, produced hydrated ferric oxide (iron oxide pigment). Vermiculite Industrial Corp., Newark, exfoliated vermiculite by heating crude material imported from Africa. The expanded vermiculite was used for loose fill, industrial insulation, plaster and concrete aggregate, and for other industrial uses. Crude gypsum was calcined at the Newark plant of Barrett Division, Allied Chemical Corp. and transferred to the company plant in Bergen County, where the material was processed into finished building products. Irvington-Baker Division of Englehard Industries, Newark, continued to refine silver, gold, and platinum-group metals from secondary sources. This operation was housed in a new research laboratory completed during 1959. New Process Metals, Inc., a subsidiary of Ronson Corp., produced misch metal for lighter flints, ferrocerium, and individual rare-earth metals at its Newark plant. Crucible Steel Co., of America made special steels in arc-melting and induction furnaces at its Spaulding Works, Harrison.

Gloucester.—Sand and gravel output totaled 418,000 tons. Mostly prepared materials, used for building and paving, were produced at operations near Bridgeport and Mount Royal. A small quantity of bank-run furnace sand was recovered near Downer. Greensand marl used for softening and treating water was recovered near Sewell by Inversand Co. Ground oystershell, used mainly for poultry grit, was produced near Franklinville. Byproduct sulfur was recovered in the liquid purification of gas by the modified Baehr process at the Eagle Point (Westville) plant of Freeport Sulphur Co. Byproduct sulfur also was recovered at the Paulsboro refinery of Mobil Oil Co.

Hudson.—Coke and coal chemicals were produced at the Kearney plant of Koppers Co., Inc., in 230 slot-type (165 Koppers and 65 Koppers-Becker) ovens with an annual capacity of 1.1 million tons. The Koppers Co. also recovered hydrogen sulfide by the Koppers hot-vacuum activation process at its Seaboard plant, Kearney. United Industrial & Chemical Corp., Bayonne, produced zinc oxide and leaded zinc oxide pigments.

Hunterdon.—Lambertville Quarry Co., Lambertville, and Houdaille Construction Materials, Inc., Oldwick, quarried and crushed basalt (traprock) for use chiefly as concrete aggregate and roadstone. Quantities of crushed granite were produced near Pattenburg. Miscellaneous dimension stone used for rough construction also was quarried in the county.

Mercer.—Pennington Quarry Co. produced a substantial tonnage of diabase (traprock) near Pennington. The entire output was prepared for use as concrete aggregate and roadstone. Basalt used for concrete aggregate and roadstone also was quarried by the Mercer County Workhouse, near Trenton. Crude feldspar, shipped mainly from an affiliated company at Quebec, Canada, was beneficiated electrostatically and ground at the Trenton plant of Golding-Keene Co. The ground feldspar was sold for use in manufacturing pottery, sanitary ware, insulators, floor tile, and grinding wheels. Most of the output was consumed in New Jersey, but limited quantities were shipped to Connecticut, Massachusetts, Pennsylvania, and Ohio.

Columbian Carbon Co., Trenton, manufactured black, brown, red, and yellow iron oxide pigments by oxidation of scrap iron. Exfoliated vermiculite was produced at Trenton from crude material shipped from out of State.

Middlesex.—The county continued as the leading clay-producing area, supplying 66 percent of the State total tonnage. County output was 459,000 tons, a 4-percent increase over 1958, and consisted mainly of miscellaneous clay used for manufacturing heavy clay products and lightweight aggregate. Production was reported by 12 companies located mainly along the Atlantic seaboard. The bulk of the fire clay produced in the county was used in manufacturing a variety of refractory products. The lightweight aggregate produced at Sayreville was sold principally in the metropolitan New York area for use in lightweight structural concrete and masonry blocks. Sand and gravel production dropped from 749,000 tons in 1958 to 656,000 tons in 1959. Seven operations throughout the county were active and produced mainly building and paving material. Limited quantities of molding, engine, blast and fill sand also were produced. Ninety-two percent of the county sand and gravel output was washed, screened, or otherwise prepared.

Coralux Perlite Corp. of New Jersey expanded perlite from crude material mined in New Mexico at its Metuchen plant for use as aggregate in acoustical plaster and ultralightweight concrete. Byproduct sulfur was recovered by the modified Claus process of gas purification at the Perth Amboy plant of the Anlin Co. Red iron oxide pigments (calcined copperas) were manufactured by Columbia Carbon Co., Monmouth Junction, and Stabilized Pigments, Inc., New Brunswick.

National Lead Co. produced titanium dioxide pigments at Sayreville and lead pigments at Perth Amboy. Zinc pigments (zinc chloride) were produced at Perth Amboy by American Smelting & Refining Co. Foreign and domestic copper matte and concentrates were refined electrolytically by Federated Metals Division of American Smelting & Refining Co. at Perth Amboy. The company also refined lead and antimony. United States Metals Refining Co., Carteret, a unit of The American Metal Co., Ltd., continued to produce electrolytic copper, oxygen-free copper, refined gold-, silver-, and platinum-group metals, selenium, tellurium, metal powders, and solder. The new mill of Phelps Dodge Copper Products Corp., near South Brunswick, began to produce capillary to large sizes of copper, brass, bronze, and cupronickel tubing and pipe.

Monmouth.—Eight operators, mainly along the Atlantic seaboard, produced 715,000 tons of sand and gravel. Output was used chiefly for building and paving purposes and was shipped entirely by truck. Production employees totaled 53 men, working 104,000 man-hours in 1959.

Morris.—Iron ore was mined and beneficiated by Alan Wood Steel Co. at the Scrub Oaks mine and by Shahmoon Industries, Inc., at the Mt. Hope mine. Alan Wood Steel Co. shipped iron concentrate to its steel plant at Conshohocken, Pa., and marketed waste rock (granite) and tailing as crushed stone for use as concrete aggregate. Crushed granite also was quarried at Hawthorne and Wharton. Morris County, with output of 1,815,000 tons, continued to rank second in production and value of sand and gravel in the State. The sand and gravel was mined at seven localities and used chiefly as building and paving material. Production employees totaled 78 men working 155,000 man-hours in 1959. Miscellaneous clay used in manufacturing flowerpots was produced near Bernardsville by Logansville Pottery, Inc.

Ocean.—Sand and gravel production, mainly building and paving material, totaled 1,149,000 tons, a 55-percent increase over 1958. Output was reported from six operations. Ninety-six percent of the sand and gravel was washed, screened, or otherwise prepared. New Jersey Pulverizing Co. produced molding, blast, engine, and other industrial sand, as well as ground sand for abrasive, filler, and foundry purposes. Production employees working at county sand and gravel plants totaled 66 men, working 137,000 man-hours in 1959.

Passaic.—The county continued to rank second in value of stone production. Basalt output totaled 2.3 million tons, a 13-percent increase over 1958. Basalt was recovered from six quarries—one each near Clifton, Haledon, Hawthorne, Little Falls, Montclair, and Prospect Park. Eighty percent of the county output was used for concrete aggregate and roadstone. Smaller quantities were produced for riprap, filler, and roofing granules. Passaic Crushed Stone Co. produced miscellaneous stone (gneiss) near Pompton Lakes. Great Notch Granule Co., Little Falls, and H. B. Reed Corp., Passaic, produced natural roofing granules. Sand and gravel production increased from 725,000 tons in 1958 to 800,000 tons in 1959. Output, chiefly structural material, was produced by five companies near Riverdale and Wayne. All county output was shipped by truck. Paterson Brick Co., Wayne, produced miscellaneous clay for use in manufacturing building brick.

Manganese ore imported from Africa was processed by Bright Star Industries, Clifton, for use in manufacturing grade-A military-type batteries. Crude perlite from Nevada was expanded at Paterson by PerAlex of New Jersey, Inc. The processed material was used as ultralight concrete aggregate, in acoustical plaster, and for soil conditioning. Davison Chemical Division, W. R. Grace & Co., Pompton Plains, produced rare-earth metals and compounds. No peat production was reported in the county in 1959.

Salem.—A small quantity of structural sand was produced near Salem by A. W. Davis Lumber Co. Paving sand and gravel also was produced under contract for the Salem County Engineer.

Somerset.—Somerset County continued as the leading stone-producing area in the State, supplying 48 percent of the total output and 43 percent of the total value. One limestone, one miscellaneous stone, and five basalt quarries were active. Basalt output totaled 4.8 million tons, a 30-percent increase over 1958. Most (95 percent) of the basalt output was used for concrete aggregate and roadstone. Quantities of stone for riprap and railroad ballast also were produced. Houdaille Construction Materials, Inc. operated quarries at Bound Brook and Millington. Other producers were Kingston Taprock Co., Kingston, Fanwood Stone Crusher and Quarry Co., Watchung, and Somerset Crushed Stone Inc., Bernardsville. Limestone and lime were produced at a quarry and plant near Peapack. Miscellaneous stone used for rough construction and as concrete aggregate and roadstone was mined near Martinsville. Natural and artificially colored roofing granules were produced by Central Commercial Co. at Bound Brook.

Building brick and other heavy clay products were made from clay mined in pits near Somerville and Middlebush. Moss and humus peat was recovered from a bog near Mount Bethel by Mount Bethel Humus Co. Johns-Manville Corp., Manville, produced expanded perlite from crude material received from Colorado. The expanded perlite was used in manufacturing pipe-covering insulation. American Cyanamid Co., Bound Brook, produced zinc pigments (zinc chloride).

Sussex.—Farber White Limestone Co., Franklin, quarried and crushed limestone for agstone, concrete aggregate, asphalt filler, fertilizer filler, roofing spar, and plaster whiting. Limestone Products Corp. of America, Newton, produced limestone for use as agstone, concrete aggregate, metallurgical flux, asphalt, rubber and other fillers, mineral food, poultry grit, filter beds, and for manufacturing lime. Hydrated lime was produced at the company Lime Crest plant and sold for masonry and agricultural uses and water purification and softening purposes. The company also produced sand and gravel at its Newton plant. Sand and gravel also was produced by other companies near Sparta and Andover. The Sterling Hill Mine (zinc) near Sterling was idle for the second consecutive year; however, byproduct manganiferous residuum from tailings of ores previously milled was recovered and shipped to the Palmerton (Pa.) smelter for treatment. Hyper-Humus Co. and Netcong Natural Products Co. recovered reed-sedge peat from bogs near Andover and Stanhope, respectively. During the year thousands of amateur gem and mineral collectors visited old-mine dumps near Franklin. Various mineral specimens, chiefly fluorescent calcite, franklinite, willemite, and zincite, were collected.

Union.—Houdaille Construction Materials, Inc., Summit, quarried and crushed basalt for use as concrete aggregate. Crude perlite from Colorado was expanded at Hillside by Certified Industrial Products Inc. The processed material was used in building plaster, concrete aggregate, soil conditioning, and as a filler. Esso Standard Oil Co. recovered hydrogen sulfide by diethanolamine treatment at its Bayway refinery. The gas was shipped to the nearby chemical plant of General Chemical Division, Allied Chemical Corp., where sulfur was recovered and used by the company. Zinc pigments (zinc sulfate) were produced at the Rahway plant of Merck & Co., Inc.

Warren.—Alan Wood Steel Co. continued to produce and beneficiate iron ore at its Washington mine. Concentrate was consumed at the company steel plant at Conshohocken, Pa. Structural and paving sand and gravel were produced near Carpentersville and Phillipsburg. Royal Green Marble Co., near Phillipsburg, quarried and crushed marble exclusively for terrazzo. A variety of refined magnesium compounds was produced from carbonates, chlorides, oxides, and sulfates of magnesium by J. T. Baker Chemical Co., Phillipsburg. The Port Murray clay pit and brick plant of Natco Corp. was idle during 1959.

The Mineral Industry of New Mexico

By F. J. Kelly,[1] William H. Kerns,[1] and D. H. Mullen[1]

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THE TOTAL value of all mineral production in New Mexico rose to $600.3 million in 1959, a 7-percent increase over the $559.8 million reported for 1958. However, portions of the State's mineral industry were affected by local and national factors that tended to limit output, particularly in the metals field. A copper strike during the last half of the year resulted in a $4.8 million decrease in copper output. Major lead and zinc mines, shut down during the latter part of 1958, were not reopened until mid-1959. The drop in value of production of these two metals in 1959 was $847,000. A reduction in the output of manganese ore resulted from the termination of the Government purchase program for this metal in August. Conversely, a $21.2 million increase in the value of uranium-ore output prevented an overall drop in the total value of metallic minerals produced in 1959. A $172,000 increase in the value of molybdenum and vanadium produced also helped raise the value for the group to $82.6 million for 1959, a 23-percent gain over 1958.

Producers in the mineral fuels group reported gains in output for all commodities except carbon dioxide and helium. As a group, fuels accounted for 70 percent of the total value of all minerals produced.

The value of nonmetals produced advanced to $94.3 million, a gain of 10 percent over 1958, and accounted for 16 percent of the total value of mineral production (1 percent greater than 1958). A $5 million increase in potash production, $1.9 million gain in sand and gravel output, and the production of cement for the first time in the history of the State were the principal reasons for the gain.

Developments of interest in the construction materials industry were the initial operation in 1959 of the first cement plant in the State, the start of construction of a gypsum products plant between Santa Fe and Albuquerque, and an announcement of plans to build a similar plant at Albuquerque.

LEGISLATION AND GOVERNMENT PROGRAMS

No new Office of Minerals Exploration (OME) contracts were signed during 1959. Some mica producers made shipments to the Government purchase depots, Spruce Pine, N.C., and Custer, S. Dak. All manganese ore and concentrate containing 40 percent or more manganese marketed during the year went into the National stockpile. The Government carlot manganese purchase program was terminated in 1959 because the quota ceiling was reached. A small quantity of Metallurgical-grade fluorspar was purchased by the Government.

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TABLE 1.—Mineral production in New Mexico[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Barite	(2)	(2)	320	$6
Beryllium concentrate, gross weight	27	$16	11	6
Clays[3], thousand short tons	40	73	45	77
Coal, do	117	719	149	837
Copper (recoverable content of ores, etc.)	55, 540	29, 214	39, 688	24, 369
Fluorspar	------------	------------	200	7
Gem stones	(4)	28	(4)	39
Gold (recoverable content of ores, etc.), troy ounces	3, 378	118	3, 155	110
Helium, thousand cubic feet	29, 793	502	16, 903	264
Lead (recoverable content of ores, etc.)	1, 117	261	829	191
Lime, thousand short tons	21	260	16	209
Manganese ore and concentrate (35 percent or more Mn), gross weight	[5] 28, 866	[5] 2, 333	27, 528	2, 248
Mica:				
Scrap	787	24	210	7
Sheet, pounds	1, 791	18	247	2
Natural gas, million cubic feet	761, 446	79, 190	[6] 777, 800	[6] 81, 700
Natural-gas liquids:				
Natural gasoline and cycle products, thousand gallons	258, 312	15, 131	264, 133	16, 859
LP-gases, do	458, 178	17, 331	552, 257	22, 320
Perlite	202, 046	1, 790	240, 642	2, 121
Petroleum (crude), thousand 42-gallon barrels	98, 515	293, 974	[6] 105, 692	[6] 301, 394
Potassium salts, thousand short tons, K_2O equivalent	1, 978	69, 106	2, 189	74, 117
Pumice, thousand short tons	507	959	493	1, 023
Salt (common), do	31	275	36	322
Sand and gravel, do	13, 205	11, 413	12, 460	13, 332
Silver (recoverable content of ores, etc.), thousand troy ounces	159	144	159	144
Stone, thousand short tons	1,730	1, 507	461	542
Uranium ore	1, 888, 499	32, 264	3, 269, 826	53, 463
Zinc (recoverable content of ores, etc.)	9, 034	1, 843	4, 636	1, 066
Value of items that cannot be disclosed: Carbon dioxide, cement (1959), fire clay, iron ore, manganiferous ore (5 to 35 percent Mn), magnesium compounds, molybdenum, vanadium, and values indicated by footnote 2	------------	1, 345	------------	3, 771
Total New Mexico[7]	------------	[5] 559, 777	------------	600, 269

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

[3] Excludes fire clay; value included with "Items that cannot be disclosed."

[4] Weight not recorded.

[5] Revised figure.

[6] Preliminary figure.

[7] Total has been adjusted to eliminate duplication in value of raw materials used in manufacturing cement (1959) and lime.

EMPLOYMENT AND INJURIES

Average employment in the mining industry in New Mexico was 19,500, compared with 19,100 in 1958. The ratio of mine workers to total nonagricultural workers dropped from 8.7 percent in 1958 to 8.5 percent in 1959. Employment in the metal mining industry increased because of the high production at uranium mines. The number of workers at petroleum and gas facilities dropped slightly. At nonmetal and coal mines a small gain in the number of workers was noted.

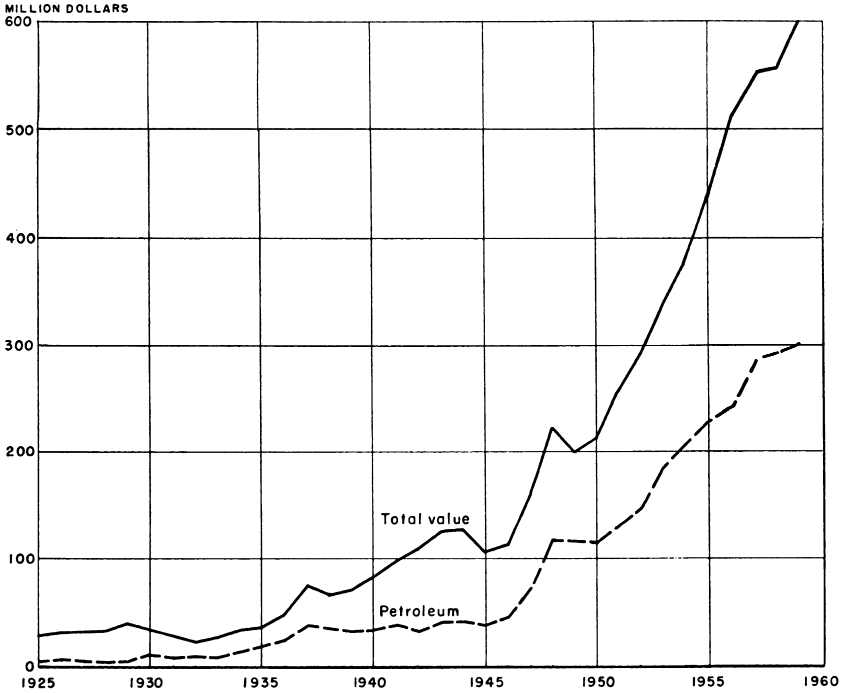

FIGURE 1.—Value of petroleum production and total value of all minerals produced in New Mexico, 1925–59.

TABLE 2.—Mining employment by types of mining

[Bureau of Labor Statistics, U.S. Department of Labor, and Employment Security Commission of New Mexico]

Industry	1958		1959	
	Average number of men [1]	Percent of total [1]	Average number of men	Percent of total
Nonagricultural total	218,700	100	229,700	100
Mining total	19,100	8.7	19,500	8.5
Metal mining	4,700	2.1	4,900	2.1
Petroleum and natural gas	10,500	4.8	10,600	4.6
Nonmetal and coal mining	3,900	1.8	4,000	1.8

[1] Revised figures.

The State Inspector of Mines[2] reported 6 fatalities and 716 lost-time accidents from July 1, 1958, to June 30, 1959. Six fatalities occurred in underground mines, three by fall of rock, two by fall of person, and one by fall of object.

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[2] Hays, William H., Forty-Seventh Annual Report by the State Inspector of Mines for the Year Ending June 30, 1959: 78 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Mineral fuels (carbon dioxide, coal, helium, natural gas, natural-gas liquids, and petroleum) represented 70 percent of the total value of all mineral production in the State. Value for fuels was 4 percent greater than in 1958.

Carbon Dioxide.—Carbon dioxide production from wells in Harding County declined 54 percent from 1958. The gas was compressed and sold to consumers as dry ice and liquid carbon dioxide; 19 million pounds of dry ice was marketed during the year. Southwestern Minerals Corp. announced plans to reopen the carbon dioxide plant at Des Moines in northern Union County. The liquified gas would be shipped by truck and tank car to consumers.

Coal.—Coal production increased 27 percent in quantity and 16 percent in value, compared with 1958. Production exceeding 1,000 tons was reported at 19 mines (16 underground and 3 strip) in 5 counties. Colfax and McKinley Counties led the State and represented 89 percent of the total coal produced.

TABLE 3.—Production of coal, by counties

(Excludes mines producing less than 1,000 tons annually)

County	1958		1959	
	Short tons	Average value per ton[1]	Short tons	Average value per ton[1]
Colfax	38,286	$6.32	82,359	$6.29
McKinley	55,932	6.47	50,316	4.62
Rio Arriba	12,312	5.64	7,830	5.91
Sandoval	1,306	2.96	1,245	3.11
San Juan	6,820	4.34	6,800	5.40
Socorro	2,000	6.00		
Total	116,656	6.16	148,550	5.64

[1] Value received or charged f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Helium.—Extracting helium from natural gas was resumed at the Shiprock plant by the Federal Bureau of Mines in July. The plant had been idle since October 1958 because of an inadequate supply of helium-bearing gas. A new supply of helium-rich gas, containing 5 to 6 percent helium, was developed and transported to the plant through an 8-inch pipeline. Production in 1959 was 43 percent below 1958.

Natural Gas.—Marketed natural gas from gas wells and processed oil-well gas increased 2 percent in quantity and 3 percent in value, compared with 1958. The quantities of gas produced in the southeastern and northwestern fields were approximately the same, with a slightly greater quantity (5 percent) from the northwest. In the southeastern counties, the greatest production was from oil-well gas; in the northwestern counties, dry gas from natural-gas wells was greater. There were 1,220 producing gas wells in the southeastern counties and 4,355 in the northwestern counties.

Information compiled by the New Mexico Oil Conservation Commission and published by the New Mexico Oil and Gas Engineering Committee showed a total production of 273.9 billion cubic feet of oil-well gas and 470.2 billion cubic feet from gas wells.

Natural-Gas Liquids.—Natural gasoline, butane, and propane were extracted from oil-well gas at 21 plants in the southeastern counties and 3 in the northwestern counties. Data collected by the Federal Bureau of Mines showed that recovery of natural gasoline increased 2 percent, and recovery of liquid-petroleum gases (butane and propane) increased 21 percent over the previous year. The annual report of the New Mexico Oil and Gas Engineering Committee showed 710.2 billion cubic feet of gas processed. Of the residual gas, 42.5 billion cubic feet was used for plant fuel, 3.6 billion for lease fuel, 29.1 billion for the production of carbon black, 587.5 billion was sold to pipeline companies, 4.4 billion was used for repressuring, and 2.1 billion was vented. Recovery of natural gasoline was 378,000 gallons; recovery of petroleum gases was 469,686 gallons. Three plants in the southeastern counties burned 49.3 billion cubic feet of gas and recovered 114.9 million pounds of carbon black.

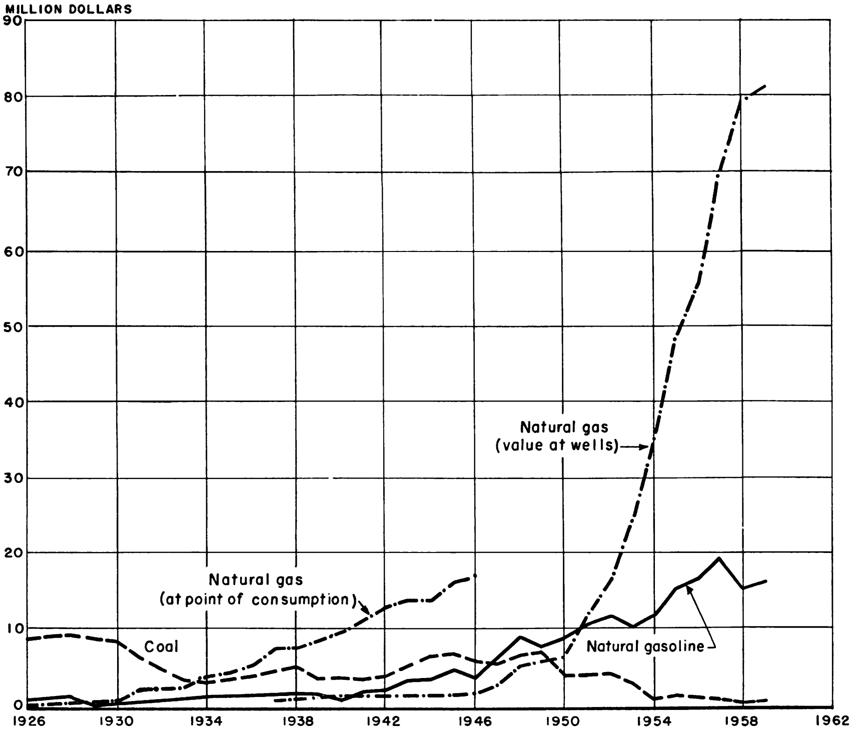

FIGURE 2.—Value of natural gas, natural gasoline, and coal in New Mexico, 1926–59.

Petroleum.—Petroleum production exceeded 100 million barrels for the first time in 1959; output of 105.7 million barrels was 7 percent greater than in 1958. The southeastern counties (Chaves, Eddy, Lea, and Roosevelt) in the Permian basin produced 87 percent of the total. Production in the northwestern counties increased 73 percent, and production in San Juan County nearly doubled that of 1958. Exploratory and development drilling was at a greater rate—2,077 completions, compared with 1,910 in the previous year. Total footage, however, declined from 8.9 to 8.7 million feet. There were 44 discoveries (33 oil, 7 condensate, and 4 gas) in 1959—the same number as in 1958. Exploratory drilling was 17 percent successful, and overall drilling was 80 percent successful, with a total of only 414 dry wells. For the first time, the number of oil wells completed in the northwestern counties exceeded the number of gas wells completed.

TABLE 4.—Production of crude petroleum, by counties [1]

(Thousand barrels)

County	1958	1959 [2]	Principal fields in 1959 in order of production
Chaves	3,215	4,125	Caprock.
Eddy	6,574	8,180	Square Lake, Red Lake, North Mason.
Lea	80,115	78,720	Denton, Gladiola, Monument, Vacuum, Hobbs, Eunice.
McKinley	114	126	Hospah.
Rio Arriba	572	898	South Blanco.
Roosevelt	372	452	Milnsand.
Sandoval	15	14	Otero.
San Juan	7,538	13,177	Bisti, Horseshoe, Verde, Chimney Rock, Gallegos.
Total	98,515	105,692	

[1] Distribution by county effected by use of New Mexico Oil Conservation Commission data adjusted to Bureau of Mines total.
[2] Preliminary figures.

TABLE 5.—Wildcat- and development-well completions in 1959, by districts and counties

[Oil and Gas Journal]

District and county	Total	Crude	Conden-sate	Gas	Dry	Service	Footage
WEST NEW MEXICO							
Wildcat:							
Catron	1				1		1,100
Hidalgo	1				1		14,600
McKinley	6	1			5		15,900
Rio Arriba	5		1		4		23,700
Sandoval	8	2	1		5		25,500
San Juan	41	6	3	2	30		163,400
Sierra	1				1		9,800
Valencia	1				1		3,700
Total	64	9	5	2	48		257,700
Development:							
McKinley	3			1	2		11,000
Rio Arriba	223	24	4	177	18		1,061,500
Sandoval	26	9		13	4		69,400
San Juan	592	368	34	141	40	9	1,872,300
Total	844	401	38	332	64	9	3,014,200
EAST NEW MEXICO							
Wildcat:							
Chaves	53	3			50		200,000
De Baca	4				4		10,100
Eddy	62	9	1	2	50		296,200
Lea	59	11			48		411,300
Lincoln	4				4		4,900
Mora	3				3		3,200
Quay	3				3		17,800
Roosevelt	4	1	1		2		39,800
San Miguel	3				3		12,600
Union	1				1		5,000
Total	196	24	2	2	168		1,000,900
Development:							
Chaves	85	66		3	13	3	251,300
Eddy	358	298	2	6	52		1,242,200
Lea	521	435	5	14	67		2,831,600
Roosevelt	9	6			2	1	86,400
Total	973	805	7	23	134	4	4,411,500
Total, all drilling	2,077	1,239	52	359	414	13	8,684,300

NONMETALS

Barite.—Galbar, Inc., took over the operation of the Mex-Tex mines from the Mex-Tex Mining Co., Inc., on July 1, 1959. From July until the end of the year 3,500 tons of barite-lead ore was mined, from which 320 tons of barite was recovered and sold for use as a constituent in oil-well drilling mud.

Cement.—With the formal dedication in mid-June of Ideal Cement Co.'s new cement plant at Tijeras, a significant milestone was reached in expansion of the State's industrial structure. The plant, about 16 miles east of Albuquerque, was the first cement-producing facility to be built in New Mexico. It was designed to produce 1.25 million barrels of cement per year and had one of the most highly instrumented control systems in the country.[3] Before the end of the year, Ideal announced plans for a $7 million expansion program at the Tijeras operation. The addition, designed to double plant capacity, would increase production to 2.5 million barrels per year.

Clays.—The continued demand for building brick and other heavy clay products in New Mexico resulted in a 5,000-ton increase in the quantity of miscellaneous clay produced in 1959. The Kinney Brick Co., Inc., of Albuquerque, was the principal mine operator and consumed all its clay output in manufacturing brick and other building materials. El Paso Brick Co. continued to operate its mine and brick plant on the northern fringe of El Paso in Dona Ana County. The San Juan Brick & Tile Co., Inc., was idle, so no clay was mined in San Juan County. Phelps Dodge Corp. produced fire clay in Dona Ana and Hidalgo Counties. Olsen Mud Service Co. and Gallup Brick & Tile Co. continued to operate mines in McKinley County and shipped the output to the oil-well drilling industry.

Fluorspar.—For the first time since 1954, crude fluorspar was mined and sold in New Mexico. The Greenleaf and Purple Pansy mines in Luna County operated for a short period, and 200 tons of ore was shipped to the Government stockpile and a consumer in Ohio.

Gem Stones.—Based on reports received from people engaged in collecting and processing gem and ornamental stones, $39,000 worth of material was collected in 1959. Agate, onyx, travertine, and chalcedony were among the more important minerals collected. Luna County (around Deming) continued to be the major area of interest to collectors.

Gypsum.—The industrial economy of New Mexico was further stimulated by the announcement of Kaiser Gypsum Co., Inc., that it planned to build a multimillion-dollar gypsum-products plant at Rosario, between Santa Fe and Albuquerque. Construction began late in the year, and the completion date was set for May or June 1960. The plant will be adjacent to a high grade gypsum deposit at Rosario, 2½ miles east of Highway No. 85 near Cerrillos. When completed, the plant will have an annual productive capacity of 120 million square feet of gypsum building products.

Excavation and grading for another gypsum plant were completed in December by general contractors for the American Gypsum Co., of Albuquerque. American Gypsum also planned to produce gypsum building products.

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[3] Pit and Quarry, Ideal Forges New Link in Chain of 16 Plants: Vol. 52, No. 3, September 1959, pp. 84–87.

Lime.—The strike at copper mines throughout the Nation adversely affected lime output by the Kennecott Copper Corp., the only producer in New Mexico. Consumption of hydrated lime was 24 percent below 1958.

Magnesium Compounds.—International Minerals & Chemical Corp. continued to recover magnesium oxide as a byproduct of potash brine. The bulk of the oxide sold went to the electrical industry.

Mica.—Recovery of sheet and scrap mica from New Mexico pegmatites continued to decline. Two hundred and forty-seven pounds of sheet mica was sold to the Government purchase depots, Spruce Pine, N.C., and Custer, S. Dak., by Mineral Resources Co., Inc., and New Mexico Mining Co. The Apache, Francis, and Globe mines, Rio Arriba County, were the source of the 14,828 pounds of hand-cobbed and 59 pounds of full-trimmed mica, from which the sheet mica was produced. The Los Compadres Mica Co., of Ojo Caliente, shipped 210 tons of scrap mica to a roofing company in Albuquerque. This mica was recovered from processing mine dumps and from small purchases of scrap mica from local individuals.

TABLE 6.—Mica sold or used by producers

	1955	1956	1957	1958	1959
Hand-cobbed mica,[1] total: Pounds	219,894	174,367	52,150	97,780	14,887
Sheet mica:[1]					
Full trimmed:					
Pounds	399	11	----------	176	59
Value	$5,559	$256	----------	$2,654	$676
Average per pound	$13.93	$23.27	----------	$15.08	$11.46
From hand-cobbed mica:					
Pounds	9,032	6,236	2,134	1,615	188
Value	$59,371	$52,310	$15,645	$15,743	$922
Average per pound	$6.57	$8.39	$7.33	$9.75	$4.90
Total:					
Pounds	9,431	6,247	2,134	1,791	247
Value	$64,930	$52,566	$15,645	$18,397	$1,598
Average per pound	$6.88	$8.41	$7.33	$10.27	$6.47
Scrap mica:					
Total:					
Short tons	84	767	1,347	787	210
Value	$2,475	$22,213	$46,865	$24,466	$6,562
Average per ton	$29.46	$28.96	$34.79	$31.09	$31.25
Sheet and scrap mica:					
Total:					
Short tons	89	770	1,348	788	210
Value	$67,405	$74,779	$62,510	$42,863	$8,160

[1] Sold to the Government through GSA.

Perlite.—Perlite sold or used by producers in New Mexico was the seventh-ranking mineral in value in 1959. A total of 350,778 tons of crude perlite was produced, of which 148,801 tons was sold, 91,841 tons used, and the remainder stockpiled. The area of Seven Hills of Taos was the principal producing region, with mines operated by Great Lakes Carbon Corp., Johns-Mansville Perlite Corp. (formerly F. E. Schundler & Co., Inc.), and United Perlite Corp. Grinding plants were operated by all these companies in conjunction with mining operations. United Perlite Corp. also produced some expanded perlite for experimental purposes at an expanding plant

TABLE 7.—Crude perlite sold or used

Year	Short tons	Value (thousands)
1955	147,805	$1,091
1956	167,705	1,271
1957	187,259	1,568
1958	202,046	1,790
1959	240,642	2,121

adjacent to its mine. Great Lakes Carbon Corp. mined and expanded perlite at Socorro, and United States Gypsum Co. mined and crushed perlite at its Grants operation.

Potash.—Mine production of potash-bearing materials (sylvinite and langbeinite) reached 13.9 million tons containing 2.6 million tons of potash salts; mine output was 14 percent greater than in 1958, but there was a slight decrease in the overall grade of ore. From this mine production, 3.7 million tons of marketable potassium salts was recovered with a K_2O equivalent of 2.2 million tons. Total stocks of potash products held by all producers were reduced by 22 percent, to 415,244 tons. Shipments of potash from the Carlsbad area reached 3.8 million tons (2.3 million tons K_2O equivalent) valued at $76.7 million; these amounts were 5 percent and 2 percent greater, respectively, than in 1958.

Farm Chemical Resources Development Corp. continued studies to improve processing techniques. No decision had been reached by the end of the year on constructing a plant to produce commercial potash.

An agreement whereby National Potash Co. would buy 2,500 tons of crude potash ore a day from Southwest Potash Corp. for blending with National's Lea County ore was announced in August by officials of the two companies.[4]

Duval Sulphur & Potash Co. began preliminary work on sinking two new shafts 5 miles north of the Southwest Potash Corp. mine site. International Minerals & Chemical Corp. announced plans to

TABLE 8.—Production and sales of potassium salts, in thousand short tons

Year	Crude salts;[1] mine production		Marketable potassium salts					
			Production			Sales		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value[2] (thousands)	Gross weight	K_2O equivalent	Value (thousands)
1955	10,956	2,159	3,221	1,899	$71,839	3,122	1,841	$69,641
1956	11,941	2,305	3,384	1,997	75,122	3,279	1,931	72,802
1957	12,893	2,430	3,528	2,080	77,197	3,353	1,977	73,243
1958	12,224	2,309	3,355	1,978	69,106	3,650	2,157	75,343
1959	13,933	2,588	3,707	2,189	74,117	3,821	2,258	76,725

[1] Sylvite and langbeinite.
[2] Derived from reported value of "Sold or used."

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[4] New Mexico Miner, National to Purchase Ore From Southwest: Vol. 21, No. 5, August–September 1959, p. 6.

spend $1 million for new mining equipment designed to permit efficient mining of narrower ore beds than present equipment allows (4 or 5 feet, compared with present 6-foot minimum). The trend toward more mechanized operations continued as all companies reported changes and revisions to the systems now being used.

Pumice.—A 3-percent decline in the sales of scoria and pumice resulted in a 7-percent drop in value. Volcanic cinders (scoria) accounted for the bulk of the material mined under this classification. Pumice was produced by General Pumice Corp., Pyramid Pumice Co., Inc. (formerly Dooley Bros. Pumice, Inc.), and Copar Pumice Co., in Rio Arriba County, Sandoval, and Santa Fe Counties, respectively. James H. Rhodes & Co. operated a pumice-grinding plant at Santa Fe.

Use of pumice and scoria as concrete aggregate accounted for 273,000 tons (55 percent) of the total consumption. Railroad ballast was the next largest use, claiming 201,000 tons (41 percent) of the total. Other uses reported included cleansing and scouring compounds, abrasives, concrete admixture, acoustic plaster, water filtration, roofing, catalysts, matches, paint, insulation, and soil conditioning.

Salt.—Shipments of salt rose to 36,000 tons, 16 percent above 1958. The principal source of raw material continued to be salt rejects from the Carlsbad potash operations. Seven companies in Eddy and Lea Counties processed tailings from potash refining and produced the bulk of the total salt output. Curtis Salt Co. recovered salt from its Quemado (Catron County) solar-evaporation facility.

Sand and Gravel.—Reduction in the mileage of highway under construction on the Federal interstate highway system was mainly responsible for the 6-percent decline in the output of sand and gravel. A report[5] showed that New Mexico ranked 37th in the Nation, with only 42.4 miles of highway under construction or open to bid in 1959.

TABLE 9.—Production of sand and gravel in 1959, by counties

County	Thousand short tons	Value (thousands)	County	Thousand short tons	Value (thousands)
Bernalillo	2,201	$2,453	Otero	769	$1,076
Catron	306	278	Quay	124	113
Chaves	1,118	1,154	Rio Arriba	815	589
Colfax	514	510	Roosevelt	(1)	(1)
Curry	206	163	Sandoval	96	74
De Baca	(1)	(1)	San Juan	246	349
Dona Ana	844	691	San Miguel	173	155
Eddy	314	271	Santa Fe	166	269
Grant	334	428	Sierra	9	28
Guadalupe	442	444	Socorro	329	224
Harding	67	70	Taos	433	388
Hidalgo	37	25	Torrance	648	614
Lea	305	449	Union	443	437
Lincoln	65	60	Valencia	408	597
Luna	104	122	Undistributed	352	426
McKinley	474	757			
Mora	118	118	Total	12,460	13,332

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

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[5] Bureau of Public Roads, Status of Federal-Aid Highway Programs, December 1959: Press release BPR 60-3.

TABLE 10.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Construction sand:				
Building	1,019	$1,204	1,195	$1,312
Paving	117	143	188	230
Fill	3	2	18	11
Other			35	19
Total sand	1,139	1,349	1,436	1,572
Construction gravel:				
Building	1,094	1,312	1,358	1,730
Paving	4,629	3,772	7,217	7,355
Railroad ballast	4	2	(1)	(1)
Fill	94	65	(1)	(1)
Other	67	67	53	26
Miscellaneous gravel			52	35
Total gravel	5,888	5,218	8,680	9,146
Total sand and gravel	7,027	6,567	10,116	10,718
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	62	168	24	29
Paving	20	29	70	44
Total sand	82	197	94	73
Gravel:				
Building	46	59	86	117
Paving	6,050	4,590	2,164	2,424
Total gravel	6,096	4,649	2,250	2,541
Total sand and gravel	6,178	4,846	2,344	2,614
ALL OPERATIONS				
Sand	1,221	1,546	1,530	1,645
Gravel	11,984	9,867	10,930	11,687
Grand total	13,205	11,413	12,460	13,332

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other" construction gravel.

The same report showed that the State ranked 5th in the Nation with 272.9 miles of interstate highway completed.

The output of paving gravel by commercial and Government-and-contractor producers declined 1.3 million tons, although the drop in output for all types of sand and gravel was only 745,200 tons because of gains in production of other types of aggregate. Bernalillo County was the leading producing area, accounting for 18 percent of the total output. The next largest producing county was Chaves, which supplied 9 percent.

Stone.—A substantial decline in the quantity of limestone produced by Government-and-contractor producers for use in road construction and elimination of a duplication in sandstone production reported in 1958 reduced the New Mexico stone output to 461,000 tons in 1959. For the first time, a substantial quantity of limestone was produced for manufacturing cement. Sharp & Fellows Contracting Co., producers of crushed sandstone for many years, reported the cessation

TABLE 11.—Production of stone in 1959, by counties

County	Short tons	Value	County	Short tons	Value
Bernalillo	(1)	(1)	Quay	40	$130
Colfax	2,144	$8,576	Rio Arriba	16,123	9,674
Eddy	(1)	(1)	San Miguel	458	10,850
Grant	37,469	43,597	Torrance	1,648	4,932
Guadalupe	905	4,545	Union	220	275
Harding	445	1,775	Valencia	159,228	162,868
Luna	60	1,100	Other counties	242,124	292,886
McKinley	306	474			
Mora	45	270	Total	461,215	541,952

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties".

TABLE 12.—Stone sold or used by producers, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955	--------	--------	20,722	$17,400	90	$1,260	276,306	$354,896
1956	--------	--------	10,915	9,100	350	4,900	(1)	(1)
1957	--------	--------	9,300	6,100	--------	--------	715,900	1,147,400
1958	26,100	$24,500	9,075	9,000	200	2,500	795,077	801,487
1959	--------	--------	1,000	5,200	37	732	224,501	298,648

Year	Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1955	812,491	$496,991	463,832	$676,118	1,573,441	$1,546,665
1956	685,129	532,017	571,841	725,820	1,268,235	1,271,837
1957	615,060	456,845	8,100	7,200	1,348,360	1,617,545
1958	900,033	669,790	--------	--------	1,730,485	1,507,277
1959	175,315	179,996	60,362	57,376	461,215	541,952

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other stone."

of quarrying operations. Detailed data on county production and types of stone quarried in 1959 are shown in tables 11 and 12.

Sulfur.—Output of elemental sulfur continued to decline in New Mexico. Only a small quantity was produced in 1959. The Eunice plant of El Paso Natural Gas Co. was the only producing facility. No sulfur was reported shipped.

Vermiculite.—The demand for exfoliated vermiculite in the State was supplied by Southwest Vermiculite Co. from its Albuquerque plant. Crude vermiculite was obtained from Libby, Mont., and the furnaced vermiculite was used as a lightweight aggregate.

METALS

Beryllium.—The Harding mine, Taos County, was operated during the first part of the year by Arthur Montgomery, who shipped 22,203 pounds of hand-cobbed beryl concentrate to the Government stockpile. The Cordillera Mining Co. leased the Harding mine and began operations in August, but no shipments were made during the remainder of the year.

Copper.—Copper production declined 16,000 tons (29 percent) compared with 1958, mainly because of a strike, which idled the State's principal copper producer (Chino mine, Chino Mines Division, Kennecott Copper Corp.) from early August to late in December. With a higher weighted average price for copper in 1959 than in 1958, value of copper output did not drop in percentage as much as in production—only $4.8 million (17 percent). Three mines, Chino in Grant County, Bonney in Hidalgo County, and the Continental (Bayard Group) in Grant County, in that order, were the principal copper producers. These mines furnished 98 percent of the State's copper output.

Gold.—Gold production declined 7 percent as a result of inactivity during the latter part of the year at the Chino mine, which recovers gold as a byproduct of copper mining. This mine, along with the Atwood-Henry Clay, Continental, Bonney, and Eighty-five supplied virtually all gold production in the State in 1959.

Iron Ore.—A test shipment of iron ore (magnetite) was made by General Mining & Milling Corp. of Colorado from the Hamlett Nos. 1 and 2 mine in Grant County to The Colorado Fuel and Iron Corp., at Pueblo, Colo., for use in making steel.

Lead.—Three mines, Linchburg in Socorro County and American and Hanover in Grant County, accounted for 89 percent of the State's lead output.

TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals[1]

Year	Mines producing		Material sold or treated[2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950-54 (average)	64	2	8,105	3,295	$115	315	$285
1955	50	6	7,447	1,917	67	251	227
1956	75	1	8,752	3,275	115	393	356
1957	60		8,060	3,212	112	309	280
1958	20		5,873	3,378	118	159	144
1959	30		4,686	3,155	110	159	144
1848-1959			(3)	2,224,056	51,176	72,036	56,820

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950-54 (average)	69,801	$35,470	4,169	$1,284	27,807	$8,969	$46,123
1955	66,417	49,547	3,296	983	15,277	3,758	54,582
1956	74,345	63,193	6,042	1,897	35,010	9,593	75,154
1957	67,472	40,618	5,294	1,514	32,680	7,582	50,106
1958	55,540	29,214	1,117	261	9,034	1,843	31,580
1959	39,688	24,369	829	191	4,636	1,066	25,880
1848-1959	2,192,946	862,245	330,954	45,868	1,195,564	223,704	1,239,813

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, old slag, or copper precipitates shipped to smelters during the calendar year indicated.

[2] Does not include gravel washed or tonnage of precipitates shipped.

[3] Figure not available.

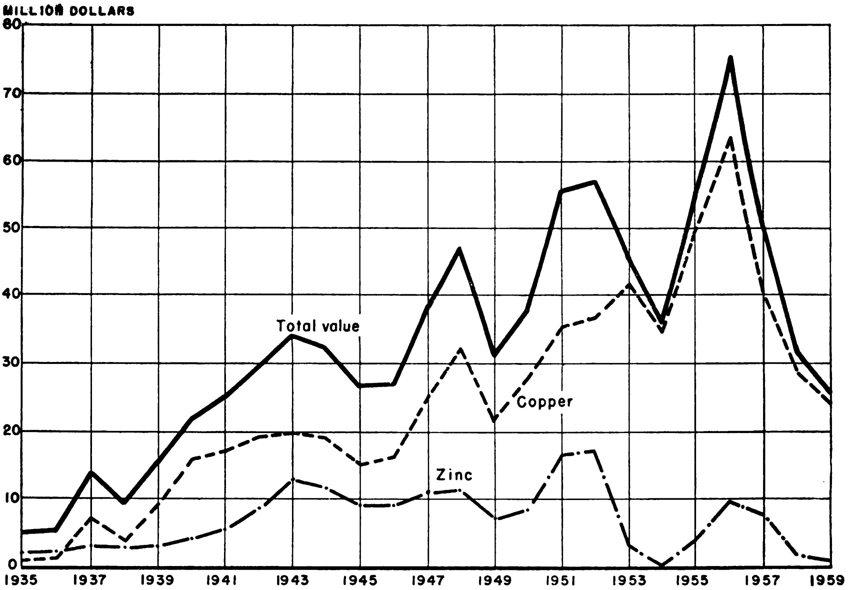

FIGURE 3.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1935–59. Value of gold, silver, and lead produced annually has been relatively small.

Manganese.—Shipments of manganese ore and concentrate under the Government carlot program administered by the GSA were reported from 52 mines in 9 counties. Socorro, with 25 active mines, was the largest producing county, and accounted for 59 percent of the output. The Black Canyon mine in Socorro County and Lake Valley mining claims in Sierra County were New Mexico's largest shippers of manganese ore in 1959. Total output from all mines declined 5 percent. All mining and milling of this material stopped when purchases under the carlot program were halted. Manganiferous ore (ferruginous ore averaging 11 percent manganese and 34 percent iron) was shipped from the Boston Hill mine in Grant County to the Pueblo (Colo.) steel plant of The Colorado Fuel and Iron Corp.

Molybdenum.—The entire output of molybdenum came from molybdenum concentrate produced by the Kennecott Copper Corp. as a byproduct of copper ore from the Chino open-pit mine, Grant County. The ore was milled at Hurley. Production of molybdenum increased, despite a strike, which idled the Chino mine for several months. The Molybdenum Corp. of America continued an exploration and development program, partly financed by a Defense Minerals Exploration Administration (DMEA) contract, at the Questa mine in Taos County. Work consisted of drifting, crosscutting, and diamond drilling.

Silver.—Production of silver was virtually the same as in 1958. The Atwood-Henry Clay was the major producer (as in 1958) followed by the Bonney, Chino, and Eighty-five mines. Output from Chino (as a byproduct of copper mining) was considerably less because of a strike.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing (lode)[1]	Lode material sold or treated[2] (short tons)	Gold		Silver	
			Troy ounces	Value	Troy ounces	Value
Catron	1	42			43	$39
Eddy	1					
Grant	10	4,601,123	[3] 1,354	[3] $47,390	43,402	39,281
Hidalgo	6	70,459	1,755	61,425	102,358	92,639
Lincoln	1	25			6	5
Mora	1	5				
Sandoval	1	75			55	50
Santa Fe	1	242	20	700	447	405
Sierra	1	23			313	283
Socorro	5	13,723	24	840	12,208	11,049
Taos	1	46			81	73
Valencia	1	52	2	70	12	11
Total:						
1959	30	4,685,815	3,155	110,425	158,925	143,835
1958	20	5,872,768	3,378	118,230	158,758	143,684

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Catron	(4)	$215					$254
Eddy	(4)	31					31
Grant	38,421	23,590,248	311	$71,484	4,011	$922,450	24,670,853
Hidalgo	1,238	760,132	41	9,418	17	4,036	927,650
Lincoln	(4)	61	(4)	12			78
Mora	(4)	61					61
Sandoval	3	1,596	(4)	12			1,658
Santa Fe	16	10,039	(4)	11			11,155
Sierra	(4)	154	(4)	92	(4)	23	552
Socorro	9	5,373	477	109,641	608	139,771	266,674
Taos	1	522					595
Valencia							81
Total:							
1959	39,688	24,368,432	829	190,670	4,636	1,066,280	25,879,642
1958	55,540	29,214,040	1,117	261,378	9,034	1,842,936	31,580,268

[1] Operations at miscellaneous cleanups not counted as a producing mine.
[2] Does not include tonnage of precipitates shipped.
[3] Includes 1 ounce of gold, valued at $35, mined from placer operation in previous years.
[4] Less than 1 ton.

Uranium.—Uranium-ore production increased 73 percent in quantity and 66 percent in value, compared with 1958. Completion of extensive development work at several mines in McKinley County and a full year's operation of the six processing plants in the State largely accounted for the gain. McKinley County led with 69 percent of the total production, followed by Valencia County. Minor production was reported in Grant, Sandoval, San Juan, and Socorro Counties. Shipments were reported from 85 operations, compared with 56 in 1958.

The reserve of uranium ore, determined by AEC as of December 31, 1959, was 55.7 million tons, averaging 0.26 percent (5.2 pounds per ton) uranium oxide, compared with 54.9 million tons of the same grade December 31, 1958.

TABLE 15.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	1	52	2	12	--------	--------	--------
Dry gold-silver	3	25, 495	1, 397	81, 752	867, 500	81, 800	35, 100
Dry silver	10	529	4	4, 298	13, 800	1, 500	200
Total	14	26, 076	1, 403	86, 062	881, 300	83, 300	35, 300
Copper	9	4, 581, 639	1, 688	41, 876	59, 885, 100	200	24, 700
Lead, lead-zinc, and zinc[2]	5	74, 552	42	30, 159	14, 700	1, 514, 500	9, 212, 000
Lead barite	1	3, 500	--------	213	--------	60, 000	--------
Total	15	4, 659, 691	1, 730	72, 248	59, 899, 800	1, 574, 700	9, 236, 700
Other "lode" material:							
Gold-silver cleanings	--------	48	21	615	1, 200	--------	--------
Copper precipitates	5	11, 819	--------	--------	18, 593, 700	--------	--------
Total	5	11, 867	21	615	18, 594, 900	--------	--------
Total "lode" material	30	4, 697, 634	3, 154	158, 925	79, 376, 000	1, 658, 000	9, 272, 000
Gravel (placer operation)	--------	--------	1	--------	--------	--------	--------
Total, all sources	30	4, 697, 634	3, 155	158, 925	79, 376, 000	1, 658, 000	9, 272, 000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Combined to avoid disclosing individual company confidential data.

TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Concentration and smelting of concentrates[1]: Ore	1, 701	71, 519	58, 924, 000	1, 549, 000	9, 232, 200
Direct-smelting:					
Ore	1, 432	86, 791	1, 693, 000	109, 000	39, 800
Gold-silver cleanings	21	615	1, 200	--------	--------
Copper precipitates	--------	--------	18, 593, 700	--------	--------
Total	1, 453	87, 406	20, 287, 900	109, 000	39, 800
Other:					
Leaching of copper ore	--------	--------	164, 100	--------	--------
Grand total	3, 154	158, 925	79, 376, 000	1, 658, 000	9, 272, 000

[1] Includes lead-barite ore concentrate.

In accordance with an AEC announcement November 24, 1958, concerning the purchase of concentrates derived from ores developed before that date, two contracts (The Anaconda Co. at Bluewater and Kerr-McGee Oil Industries, Inc., at Shiprock) were extended to December 31, 1966. The termination dates of the original contracts were 1962 and 1959, respectively. A third contract (Phillips Petroleum Co. at Ambrosia Lake) was amended to provide for deferring part of the pre-1962 production from company-owned properties to the 1962–66 period and for processing ores from certain independent producers. The termination date of the contract remained the same, December 31, 1966.

Vanadium.—Vanadium was recovered from uranium ores processed at plants having vanadium-recovery units. The vanadium was credited to New Mexico. Quantity recovered in 1959 was nearly five times that recovered in 1958. The processing plant of Kerr-McGee Oil Industries, Inc., Shiprock, was idle for several months at the end of the year while vanadium-recovery facilities were being completed. Operations were to resume early in 1960.

Zinc.—Total output of zinc was one-half that of 1958, although production from the State's leading zinc producer, Hanover mine, Grant County, was virtually the same as in 1958. The Linchburg mine, Socorro County, was the second largest zinc producer, followed by Atwood-Henry Clay and Continental (Bayard) mines.

REVIEW BY COUNTIES

Bernalillo.—Nonmetals comprised the entire mineral production of the county. Sand and gravel from 15 operations was the principal commodity, supplying 50 percent of the total value. Production of cement from New Mexico's first plant added substantially to the county total. Kinney Brick Co., Inc. (the only clay producer) continued to mine the bulk of the State's output of miscellaneous clay. Edgar D. Otto & Son, Inc., from the Blackbird mine, and Lavaland Heights Block Co., from the Frank Bond lease, produced scoria.

Chaves.—Petroleum production, from 635 wells, was 4.1 million barrels, 28 percent greater than in 1958. Three new fields were discovered from 53 completed exploratory wells. Development drilling, consisting of 85 completions, resulted in 66 producing oil wells and 3 gas wells.

The county ranked fourth in the State in production of petroleum and sixth in production of natural gas. The county was the second largest source of sand and gravel. Eleven operators produced 1.1 million tons of sand and gravel.

Colfax.—Coal production from five mines on the Raton, Yankee, and Old Yankee seams was more than double that of 1958. Major production was from the Koehler mine operated by Kaiser Steel Corp.; most of the output of the mine was used to manufacture coke at the company steel plant at Fontana, Calif. A fire, which curtailed operations in 1958 at the Koehler mine, was controlled and normal operations were resumed and accounted for the increased production.

Dona Ana.—Maynez Block Co. and Volcanic Cinder Co. produced 75,000 tons of scoria in 1959. Highway-construction activity was nearly the same as in 1958. The El Paso Brick Co. continued to be the only clay producer. Small quantities of manganese ore were shipped from three mines (Blackie, Blackie Nos. 1 and 2, and Michele Placer No. 1) under the Government carlot program administered by GSA.

Eddy.—Increased production of potash and petroleum in Eddy County accounted for a large part of the $8.2 million advance in total value of mineral output.

TABLE 17.—Value of mineral production in New Mexico, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Bernalillo	$1,670,169	$4,954,799	Sand and gravel, cement, stone, pumice, clays.
Catron	21,071	303,625	Sand and gravel, salt, gem stones, copper, silver.
Chaves[1]	10,254,200	12,917,600	Petroleum, sand and gravel.
Colfax	303,420	1,036,955	Coal, sand and gravel, stone.
Curry		162,800	Sand and gravel.
De Baca	15,800	83,500	Do.
Dona Ana	827,464	845,811	Sand and gravel, pumice, clays, manganese ore and concentrate.
Eddy[2]	85,044,360	93,244,773	Potassium salts, petroleum, magnesium compounds, salt, sand and gravel, stone, gem stones, copper.
Grant	32,423,674	26,428,748	Copper, zinc, molybdenum, sand and gravel, lime, manganiferous ore, manganese ore and concentrate, lead, gold, stone, silver, iron ore, pumice, uranium ore, gem stones.
Guadalupe	250,400	448,845	Sand and gravel, stone.
Harding[3]		71,375	Do.
Hidalgo	628,903	991,698	Copper, silver, gold, manganese ore and concentrate, sand and gravel, lead, clays, zinc.
Lea[2]	[4] 243,932,541	230,733,978	Petroleum, potassium salts, sand and gravel, salt.
Lincoln	47,800	66,405	Sand and gravel, manganese ore and concentrate, copper, lead, silver.
Luna	126,100	484,665	Manganese ore and concentrate, sand and gravel, gem stones, fluorspar, stone.
McKinley	13,782,004	[1] 39,662,610	Uranium ore, sand and gravel, petroleum, coal, clays, stone, gem stones.
Mora		118,431	Sand and gravel, stone, copper.
Otero	516,231	1,076,200	Sand and gravel.
Quay	273,400	112,830	Sand and gravel, stone.
Rio Arriba	[1] 2,293,767	[2] 3,345,132	Petroleum, sand and gravel, pumice, coal, stone, mica (scrap), mica (sheet), gem stones.
Roosevelt[1]	1,361,000	1,629,900	Petroleum, sand and gravel.
Sandoval[1]	487,187	237,627	Pumice, sand and gravel, petroleum, manganese ore and concentrate, coal, uranium ore, copper, gem stones, silver, lead.
San Juan[5]	23,868,236	38,243,718	Petroleum, sand and gravel, helium, coal, uranium ore, gem stones.
San Miguel	83,950	165,550	Sand and gravel, stone.
Santa Fe	732,813	537,350	Sand and gravel, pumice, copper, manganese ore and concentrate, gold, silver, gem stones, lead.
Sierra	169,860	422,382	Manganese ore and concentrate, sand and gravel, gem stones, silver, copper, lead, zinc.
Socorro	[4] 4,961,751	2,073,645	Manganese ore and concentrate, sand and gravel, perlite, zinc, lead, silver, barite, copper, gold, gem stones, uranium ore.
Taos	946,668	1,755,891	Perlite, sand and gravel, beryllium concentrate, copper, gem stones, silver.
Torrance	496,000	618,932	Sand and gravel, stone.
Union	343,368	815,660	Sand and gravel, pumice, stone.
Valencia	(6)	(6)	Uranium ore, sand and gravel, perlite, stone, gem stones, gold, silver.
Undistributed[7]	133,975,819	137,375,502	
Total	[4] [8] 559,777,000	[9] 600,269,000	

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[1] Excludes natural gas.

[2] Excludes natural gas and natural-gas liquids.

[3] Excludes carbon dioxide (natural).

[4] Revised figure.

[5] Excludes natural gas, natural-gas liquids, and vanadium.

[6] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed".

[7] Includes all natural gas, natural-gas liquids, carbon dioxide, vanadium, and some stone (1958), manganese ore and concentrate (1958), gem stones, and values indicated by footnote 6.

[8] Adjusted to eliminate duplicating the value of raw materials used in the production of lime.

[9] Adjusted to eliminate duplicating the value of raw materials used in the production of cement, lime, and marketable potassium compounds.

Petroleum production, from 2,913 wells, was 8.2 million barrels—24 percent greater than in 1958. Besides oil-well gas, natural gas was produced from 1,180 wells. Frontier Natural Gas Co. and Valley Gas Corp. operated natural-gas plants at Loco Hills and recovered natural gasoline, propane, and butane. Residual gas was sold to pipeline companies. Exploration drilling, consisting of 62 wells, resulted in 9 oil wells, 1 condensate well, and 2 gas wells. Development drilling resulted in 298 oil wells, 2 condensate wells, and 6 gas wells from 358 completed wells.

Grant.—The Chino open-pit copper mine at Santa Rita in the Central district of Grant County, operated by the Chino Mines Division, Kennecott Copper Corp., produced most of the copper, all of the molybdenum, and part of the gold and silver output in the county and State. In its annual report for 1959, the company stated that 4.5 million tons of ore was mined and milled at the Chino operation in 1959, compared with 5.5 million tons in 1958. The copper content of the ore mined was reported as 16.0 pounds per ton, compared with 18.3 pounds in 1958. Total copper produced from all sources was 37,500 tons, a significant drop from the 54,300 tons produced in 1958. The decline in ore production and copper output resulted from a labor dispute early in August, which led to a strike authorized by the officials of the International Union of Mine, Mill, and Smelter Workers. The strike closed the Chino mine, mill, and smelter throughout most of August until almost the end of the year. Operations at the plant for the precipitation of copper from drainage water from the pit and leaching the waste dumps continued during the strike, manned by supervisory personnel. Preliminary excavation for the installation of a skip hoist in the pit was completed. The 16,000-kilowatt powerplant and expanded leaching and precipitating facilities neared completion. Kennecott continued to calcine limestone to produce lime for its smelting operation, but output was 24 percent below the 1958 figure because of the strike.

United States Smelting Refining and Mining Co. reopened its Continental mine in the Bayard group to leasers (Patten & Galassini and Ray J. Holmquist) in July 1959, following inactivity since April 1958. The Bayard mill was reopened by the company in August 1959 (inactive since May 1958) to process copper ore produced by the lessees. Copper was the principal mineral in the ore, but some zinc, gold, and silver were recovered. The Zuniga mine, leased from the company, was operated by Douglas B. White, who recovered copper from Zuniga ore by heap leaching in vats.

The Hanover mine (in past years, an important lead, zinc, and silver producer in the State and closed in May 1958) was reactivated in August 1959 by The New Jersey Zinc Co. By yearend, the mine and mill were being operated at the normal rate.

The Peru Mining Co. Kearney mine, which had been closed for 3 years, was being reopened at the end of the year as a result of a joint venture between Hydrometals, Inc., parent company of Peru, and American Zinc, Lead, and Smelting Co. Ore will be concentrated at Peru's plant at Deming, and the concentrate shipped to American Zinc's slab zinc plant at Dumas, Tex.

Twenty-five operations recovered copper from Santa Rita Creek water by precipitation.

General Mining & Milling Corp., of Colorado, made a test shipment of iron ore (magnetite) from Hamlett Nos. 1 and 2 mine to The Colorado Fuel and Iron Corp., Pueblo, Colo. Manganese ore and concentrate was shipped from five mines in the county under the Government carlot purchase program administered by GSA. This ore and concentrate, 1,367 short wet tons, averaging 41.8 percent manganese and valued at $109,000, came principally from three mines (Cliffroy, Bear Mountain, and Cliffroy No. 2). The Luck Mining Co. shipped manganiferous ore from the Boston Hill mine near Silver City to The Colorado Fuel and Iron Corp., Pueblo, Colo. The ore, containing 11 percent manganese and 34 percent iron, was used for making steel.

Robert A. Elgin reported production of 210 tons of scoria from a pit near Silver City. A small quantity of uranium ore produced at the Floyd Collins mine by Leach & Leach was shipped to Grants for processing.

Hidalgo.—Production was resumed on a 2-shift-per-day basis in May 1959 at the Banner Mining Co. Bonney mine, Lordsburg, after an extended shutdown period, which began in October 1957. A limited quantity of ore from development work conducted during the shutdown was milled, and the concentrate was marketed in 1958. This operation was the county's largest copper producer and the second largest copper producer in the State. Byproduct gold and silver also were recovered from the copper ore. According to the company annual report for 1959, 44,846 tons of copper ore was mined and milled at the operation, and 1,558 feet of drifts and 362 feet of raises were completed.

Brannan & Fuller produced gold-silver ore containing some recoverable copper, lead, and zinc from the Atwood-Henry Clay mines and the Eighty-five mine near Lordsburg and shipped it to the American Smelting and Refining Co. (El Paso, Tex.) copper smelter.

Manganese ore and concentrate valued at $31,000, all from two mines, was shipped under the Government carlot purchase program administered by GSA.

Small quantities of fire clay were mined from the Pratt Fire Clay quarry by Phelps Dodge Corp.

Lea.—Lea County led the State in production of petroleum from 8,377 wells, which reached 78.7 million barrels in 1959. This amount was 2 percent below that of 1958. Natural gas was produced from 1,180 wells, and oil-well gas was processed at 19 plants for the recovery of natural gasoline, butane, and propane. Residual gas was sold to pipeline companies, used for repressuring, and producing carbon black. Three companies produced carbon black from natural gas. Two plants at Eunice also produced carbon black besides natural-gas liquids. Exploratory wells completed totaled 59, of which 11 were producers. Completed development wells numbered 521, of which 435 were oil wells, 5 condensate wells, and 14 gas wells.

National Potash Co. continued to mine and refine potash at its operation east of Carlsbad. Some ore was purchased from Southwest Potash Corp. in Eddy County for blending with Lea County ore.

Salt-processing plants (principally dryers) were operated at Eunice and Loving by Industrial Salt Co. and Lee S. Williams.

Luna.—Value of the manganese ore and concentrate produced from 6 mines and shipped under the Government carlot purchase program accounted for 70 percent of the total value of mineral production in the county. A total of 4,000 short wet tons of this material was shipped, with an average manganese content of 41.8 percent and valued at $340,000. Mines with the largest output were Manganese Valley, State Lease 64–10, and Ruth Claims.

McKinley.—Coal production from four underground mines and three strip mines was 10 percent below that of 1958. Major producers were the Roberts Coal Co., operating the Roberts strip mine, and Navajo Tribal Enterprises, operating the Window Rock underground mine. Petroleum was produced from 53 wells, and increased 11 percent over that of 1958. Six exploratory wells and three development wells were completed, of which one oil well and one gas well were producers.

The county led the State in uranium-ore production, surpassing Valencia County. Completion of much deep development work and a full year's operation of the four processing plants serving the Ambrosia Lake area were largely responsible for the gain in production. Major producers were Phillips Petroleum Co. at the Ann Lee, Branson 33, Faith, Isabella, Sandstone, Section 11, and Section 21 mines; Mid-Continent Exploration Co. and Rio De Oro Mines, Inc., at the Dysart shaft; and Mid-Continent Mining Co. and Rio De Oro Mines, Inc., at the Section 11 mines; Calumet & Hecla, Inc., at the Marquez mine; Kermac Nuclear Fuels Corp. at the Sections 10, 22, 24, 30, and 33 mines; Homestake-Sapin Partners at the Sections 15, 23, and 25 mines; Haystack Mountain Development Co. at its Sections 19 and 25 mines; and Homestake-New Mexico Partners at its Section 32 mine. The Kermac-Nuclear Fuels Corp. 3,300-ton-a-day plant and Phillips Petroleum Co. 1,725-ton-a-day plant at Ambrosia Lake operated the entire year. The uranium concentrate purchase contract between AEC and Phillips Petroleum Co. was amended to defer the delivery of approximately 1 million pounds of concentrate from company-controlled mines from the pre-1962 period to the 1962–66 period, and to provide for the processing of ores from certain independent producers.

Rio Arriba.—Petroleum production from 90 wells in Rio Arriba County was 898,000 barrels, 57 percent more than in 1958. Natural gas was recovered at 1,135 gas wells. Southern Union Gas Co. recovered natural gasoline, butane, and propane in its natural-gas plant at Lybrook. Development drilling resulted in 24 oil wells, 4 condensate wells, and 177 gas wells from 223 completed wells. Coal production from 4 operations declined 36 percent from that of 1958.

General Pumice Corp. operated its Cullum pumice mine, and supplied raw material to a number of building-block manufacturers throughout the State and to a pumice grinding plant at Santa Fe. Output of mica (both scrap and sheet) registered a marked drop during the year. With the closing of the Petaca mica mill, which produced fine ground mica for consumers outside the State, in 1958, the output of ground mica was limited to coarse ground material used by the roofing industry.

Roosevelt.—Petroleum production of 452,000 barrels from 21 wells was 22 percent greater than in 1958. A small quantity of oil-well gas also was produced. There was no exploratory or development drilling during the year.

Sandoval.—Mine production of scoria and pumice by Big Chief Mining Co., Pyramid Pumice Co., Inc., and Lava-Pumice, Inc., accounted for 41 percent of the total value of all minerals produced in the county. Coal production (all from the Padilla mine) was approximately the same as in 1958. Petroleum output from 12 wells declined 7 percent from the previous year. A small quantity of uranium ore produced at the Warm Springs mine was processed at one of the mills in the Ambrosia Lake area.

Jim McRee operated the Lander mine and shipped manganese ore and concentrate under the Government carlot program. Eads Mining Co. shipped copper ore (from which small quantities of silver and lead were also recovered) from the San Miguel mine to the American Smelting and Refining Co. copper smelter at El Paso, Tex.

San Juan.—Petroleum production from 1,075 wells was 13.1 million barrels, a 75-percent increase over that of 1958. Natural gas was produced from 3,220 gas wells. Exploratory and development drilling continued but at a lesser rate than in the previous year; however, the success ratio was remarkably high. Of the 41 exploratory wells completed, 6 were oil wells, 3 condensate wells, and 2 gas wells. Development drilling was greatest in the Bisti, Verde, Horseshoe Canyon, and Chimney Rock oilfields and in the Blanco gas "trend." Completion of 592 development wells resulted in 368 oil wells, 34 condensate wells, and 141 gas wells. Limits of the producing fields were not determined. A major miscible-phase flooding operation of the Gallup sandstone in the central part of the Bisti field was started; the unit covered 7,300 acres and had 63 producing wells. The initial phase was injection of liquid-petroleum gases, then injection of natural gas, and finally a waterflood to sweep all available oil to the producing wells. The program was expected to recover 12 million barrels of oil, twice that expected under normal depletion. The project was based on the results of a pilot operation begun in September 1957 on a 40-acre tract of the same field. To June 1959 an estimated 53 percent of the oil in place had been recovered.

Kimbell-Campbell Corp. completed a 200-barrel-a-day refinery at Bloomfield. The corporation produced gasoline, diesel fuel, jet fuel, and other products from crude oil produced at its own wells and from distillate produced by other companies.

The Federal Bureau of Mines resumed operation at its Navajo helium plant at Shiprock in August. Helium-rich gas (5.8 percent helium) produced by Pan American Petroleum Corp. was delivered to the plant through an 8-mile pipeline from a new source developed by the corporation. Natural gasoline, butane, and propane were recovered at the El Paso Natural Gas Co. San Juan plant and the Kutz Canyon plant. Residual gas was transported through pipelines to consumers.

Coal production (from the Hogback No. 11 and Hogback No. 12A mines by Frank Pashlakai and Simpson Coal Co.) was about the same as in 1958. Uranium ore was produced at the Pope No. 1 and Sanastee mines in the Carrizo Mountains and shipped to plants in Durango, Colo., and Shiprock for processing. The uranium-processing plant at Navajo Uranium Division, Kerr-McGee Oil Industries, Inc., at Shiprock operated until November, when the plant was idled for installation of facilities for recovery of vanadium oxide. Operations were to be resumed in January or February 1960. The company's concentrate-purchase contract with AEC was extended from its termination date of October 31, 1959, to June 30, 1965. Most ore processed came from the Navajo Indian Reservation.

Santa Fe.—Reduction in the quantity of sand and gravel produced during the year was the major reason for the decline in the total value of mineral production reported for Santa Fe County. The value of pumice and scoria mined increased slightly but the quantity of lower priced scoria declined. The same producers were active in both 1958 and 1959.

Tom B. Scartaccini produced copper ore from the San Pedro mine, milled some of the ore, and shipped concentrate and some ore directly to the smelter. He also shipped manganese ore from this property under the Government carlot program. D. A. G. Co., Inc., produced manganese ore from the McDuff Lease and shipped it under the carlot program.

Sierra.—Ninety-three percent of the county's total value of mineral production came from manganese ore and concentrate shipped under the Government carlot program. Most output came from the Lake Valley mining claims operated by Los Lamos Mining Co., one of seven producing manganese mines. Small quantities of silver, copper, lead, and zinc were recovered from a shipment of ore produced from one mine.

Socorro.—Two-thirds of the value of mineral production in the county was supplied by manganese ore and concentrate shipped from 25 mines under the Government carlot program; the 16,320 short wet tons shipped (averaging 42.6 percent manganese) represented more than one-half the State's output. The major producer in the county and in the State was Joe Gianera from the Black Canyon mine.

Output from five mines accounted for the county's production of gold, silver, copper, lead, and zinc. By far the leading producer of these metals in the county was Patten & Galassini, operating the Linchburg mine under lease from The New Jersey Zinc Co. The mine, reopened in August 1959, had been inactive since May 1958. The ore was shipped to New Jersey Zinc's Hanover mill for concentration.

Both the Mex-Tex mine (near Bingham) and the mill (north of San Antonio) were acquired by Galbar, Inc., July 1, 1959. Lead-barite ore was mined and milled and lead and barite concentrates were produced. The lead concentrate was shipped to the American Smelting and Refining Co. lead plant at El Paso, Tex., and the barite concentrate was ground for use in well drilling. Operations were discontinued in November.

A test shipment of siliceous flux containing small quantities of silver, copper, and lead was made to the American Smelting and Refining Co. (El Paso, Tex.) copper smelter from the Copper Sill mine by Kirchman & Hodge.

A small quantity of uranium ore was produced by Henderson Robinson at their Section 13 mine and shipped to the plant at Shiprock for processing. The Great Lakes Carbon Corp. mine and expanding plant at Socorro were active throughout 1959.

Taos.—Perlite, from the area of the Seven Hills of Taos, was again the dominant mineral produced in the county. Highway-construction activity increased, and total output of sand and gravel reached 433,100 tons. Beryl crystals continued to be recovered from the Harding mine near Dixon, but output was less than half the 1958 figure.

Valencia.—The county was second in the State in the production of uranium ore, being surpassed only by McKinley County. The major producer was The Anaconda Co. operating its Jackpile, Section 9, and Section 33 mines. Rare Metals Corp. began operations at its San Mateo mine. Loyd O. Sutton, St. Anthony Uranium Corp., and Sutton & Sutton also produced uranium ore. Ore was processed in plants at Bluewater, Grants, and Ambrosia Lake. The Anaconda Co. closed its Sections 9 and 33 mines and the carbonate-leach section of its mill at Bluewater on May 1 in accordance with an extension of its concentrate purchase contract with AEC. The new contract, replacing the original contract signed in December 1951, provided for the deferral of delivery of approximately 4 million pounds of uranium oxide concentrate of pre-1962 production to the 1962–66 period. Under the deferral plan, the mill operated 6 days a week at a daily rate of about 3,000 tons of ore. Previously, the mill operated 7 days a week at a daily rate of approximately 3,500 tons of ore. Upon completing the contract (December 31, 1966), the company will have mined and processed less than half of the ore reserve developed at its mines before November 24, 1958.

Processing plants of Homestake-Sapin Partners and Homestake-New Mexico Partners at Grants operated the entire year with increasingly favorable results. Crude ore for these mills came from company-controlled mines and independent operators in McKinley County.

The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the New York State Science Service.

By Joseph Krickich,[1] Robert W. Metcalf,[1] and Robert E. Ela[2]

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THE VALUE of New York's mineral production in 1959 was the third highest on record and was only $9 million below the peak year of 1957. The year saw greater output of cement, stone, sand and gravel, iron ore, and gypsum, reflecting increased activity in building and construction. Notable among the various construction projects vitally affecting the mineral industry in the State during the year, were completion of the St. Lawrence Seaway project in upper New York and the beginning of construction at the Niagara Power project in Niagara County.

TABLE 1.—Mineral production in New York[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	1,085	$1,418	1,310	$1,714
Emery ... short tons	7,687	126	8,555	150
Gem stones	(2)	8	(2)	8
Gypsum	834	3,869	919	4,663
Iron ore (usable) ... thousand long tons, gross weight	1,944	25,683	[3] 2,044	[3] 28,050
Lead (recoverable content of ores, etc.) ... short tons	579	135	481	111
Natural gas ... million cubic feet	2,808	859	[4] 4,000	[4] 1,320
Peat ... short tons	13,606	117	12,875	138
Petroleum (crude) ... thousand 42-gallon barrels	1,763	7,457	[4] 1,981	[4] 8,399
Salt (common)	3,896	30,609	4,011	30,958
Sand and gravel	24,730	27,541	27,944	31,415
Silver (recoverable content of ores, etc.) thousand troy ounces	67	60	52	47
Stone	22,598	38,219	28,640	46,556
Zinc (recoverable content of ores, etc.) ... short tons	53,014	10,815	43,464	9,997
Value of items that cannot be disclosed: Abrasive garnet, cement, crude iron oxide pigments (1958), lime, talc, titanium concentrate, and wollastonite		61,859		76,904
Total New York[5]		[6] 205,338		235,119

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Includes crude iron oxide pigments.
[4] Preliminary figure.
[5] Total adjusted to avoid duplicating value of clays and stone.
[6] Revised figure.

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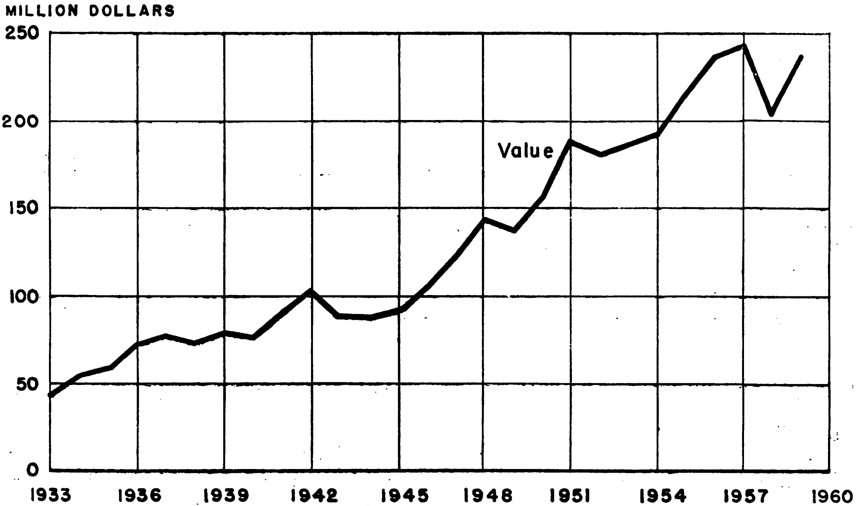

FIGURE 1.—Total value of mineral production in New York, 1933–59.

Employment and Injuries.—Injury experience in selected metallic and nonmetallic mineral industries was better than in 1958. In the stone, cement, and lime industries (quarries and mills) no fatalities were reported in 1959 (1 was reported in 1958). Nonfatal injuries dropped from 176 to 121 in 1959. One fatal injury was reported in the metal industries in both 1958 and 1959; the number of nonfatal injuries dropped from 46 in 1958 to 33 in 1959.

The Buffalo plant (Erie County), of Kelley Island New York Corp., was awarded a Certificate of Achievement in Safety in the National Lime Association safety competition for working 49,425 man-hours without a lost-time injury. The Akron mine (Erie County) of Bestwall Gypsum Co. was awarded a trophy for having the lowest injury-severity rate in the nonmetal group of the National Safety Competition of 1959. The mine worked 265,192 man-hours in 1959 without a lost-time injury. Each employee and official of the operation received a Certificate of Accomplishment in Safety. The Clinton Point quarry (New Hamburg, Dutchess County), of New York Trap Rock Corp., was cited for working 340,112 man-hours in 1959 without a lost-time injury.

TABLE 2.—Employment and injuries for selected mineral industries in 1959 [1] [2]

Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Number of injuries per million man-hours
			Fatal	Nonfatal	
Coke ovens	971	2,836,680	1	7	2.82
Clays	798	1,527,836		67	43.85
Metals	2,075	3,372,879	1	33	10.08
Nonmetals [3]	2,043	4,501,327		57	12.66
Quarries and mills [4]	4,169	9,416,815		121	12.85
Sand and gravel [5]	1,759	2,837,610	1	25	9.16

[1] Preliminary data.
[2] Production employees.
[3] Includes emery, garnet, gypsum, salt, and talc.
[4] Includes cement and lime plants having no quarry operations.
[5] Commercial producers only.

Trends and Developments.—The opening of the St. Lawrence Seaway on April 25 was of outstanding importance to industry in New York State, as well as to all Canadian and United States industries. The project connecting the Great Lakes to the Atlantic Ocean and representing a $650 million investment for the electric-power-generating plants alone was shared equally by New York and Ontario. The 3,220 foot Moses-Saunders Dam with its 32 generators (16 on the Canadian side and 16 in the United States) has a capacity of 1,900,000 kw., the second largest hydroelectric project in the Western Hemisphere. Industries, municipalities, State and local governments, and the Power Authority, will all draw increments of power from this mammoth project. Among the industrial corporations using this power, are the Aluminum Company of America and Reynolds Metals Co. The former was the first aluminum plant to be established in the Massena area. Power was obtained originally from a company-owned dam. When the Seaway brought power from the Moses-Saunders Dam, the company spent $25 million to renovate and enlarge its plant, and ultimately increase its annual capacity from 112,500 tons to 150,000 tons. The other aluminum company, Reynolds Metals, was building a 100,000-ton-a-year primary aluminum plant near Massena at an estimated cost of $88 million. Alumina, the raw material made from bauxite, was being shipped by rail to Massena from Texas and Arkansas. Of particular interest will be the transfer of aluminum in molten form to a nearby automobile plant for making aluminum castings and other aluminum parts used in cars.

Of particular significance to industries in the Niagara Frontier area was the beginning of construction of the $700 million Niagara Power project under the direction of the New York State Power Authority. The main feature of the project was the construction of a 1,950,000-kw. powerplant 7 miles below Niagara Falls. Water from the Niagara River above the falls was to be diverted 4 miles through two 46- by 66-ft. underground conduits and then through a mile-long canal to the main generating plant. Some of the water will be pumped to a storage reservoir to be used during periods of peak demand for power. To facilitate construction, a large aggregate plant capable of turning out 2,000 tons per hour of crushed stone and sand was erected at the site. The plant will produce 7 million tons of aggregate and 3 million tons of sand from limestone recovered in the construction of the canal over the 3-year construction period. A direct result of the Niagara Power project will be a $170 million industrial expansion in the area. Thirteen companies, principally in the chemical and metallurgical industries, will erect new facilities, creating about 3,100 new jobs in the region.

The 200,000-kw. power allocated to these industries is in addition to 445,000 kw. previously allocated to area industries, including metal, abrasive, metallurgical, and chemical firms. More than one-quarter (55,000 kw.) will go to Hooker Chemical Co. Sizable blocks of power were allocated to Bethlehem Steel Co., Speer Carbon Co., Carborundum Co., General Motors Corp., Pittsburgh Metallurgical Co., Stauffer Chemical Co., and National Lead Co.

Construction continued during 1959 on a new $6 million grinding-wheel plant of the Carborundum Co. at Niagara Falls. The plant was to manufacture 2- to 14-inch grinding wheels. As a consequence of a favorable labor contract negotiated with the Oil, Chemical and Atomic Workers Union, plant facilities estimated to cost $4 million for making other vitrified products were to be erected at a later date.

General Electric Co., Liverpool, near Syracuse, developed four new-type high-frequency NPN silicon transistors, designed for general-purpose amplifier and switching use in military and industrial equipment. During the year the company also revealed its method of manufacturing synthetic diamonds. The process involved elevated temperatures, high pressures, and metallic catalysts including chromium, cobalt, rhenium, ruthenium, platinum, tantalum, and others. The temperatures and pressures may vary from 2,200° to 4,400° F. and 800,000 to 1.8 million p.s.i., respectively. Without the catalyst, the reactions would require over 7,000° F. temperature and pressures of 3 million p.s.i.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—In terms of value, cement continued to be New York's most important mineral commodity in 1959. Portland, masonry, and natural cements were produced; portland cement comprised 94 percent of the total value. Although production was curtailed because of high inventories at two plants in the State, output of portland cement increased 16 percent. The increase was due primarily to increased construction activity and to the addition of a new cement plant in Ulster County. Output of masonry cement decreased by 137,000 barrels from the level of 1958. The decline in output of masonry cement was due mainly to the closing of a plant in Erie County in May. Natural-cement output was slightly higher than for the previous year. An increase in the average value per barrel of each type of cement was recorded for the year: portland cement from $3.31 in 1958 to $3.37 in 1959, masonry cement from $3.44 to $3.57, and natural cement from $3.48 to $3.50. Greene County replaced Columbia County as the leading cement-producing area. Other cement-producing counties, in decreasing order of value, were: Erie, Ulster, Warren, Schoharie, and Onondaga. Natural cement was produced in Ulster County.

The principal raw materials used for manufacturing portland cement are limestone and cement rock. Totals of 2.7 million tons of limestone and 2.0 million tons of cement rock were used. In addition, the following tonnages of raw materials were used: clay and shale, 355,000; gypsum, 113,000; sand, 46,000; iron materials, 32,000; and slag, 3,000. Quantities of carbon black and air-entraining compounds also were utilized. Types of portland cement produced included general use (types I–II), high- early-strength (type III), oil well, and portland slag.

The bulk of the cement was consumed in New York, the New England States, and other Northeastern States. A percentage breakdown by types of customers of 8 of the 11 producers of portland cement was: ready-mix concrete companies, 49 percent; concrete-product manufacturers, 20 percent; highway and other contractors, 18 percent; and building-material dealers, 12 percent. The remainder was shipped to

Federal, State, and local government agencies, and miscellaneous customers. Fifty-nine percent of the finished portland cement was shipped by rail; the remainder was shipped by truck (35 percent) and water (6 percent).

Annual finished-cement capacity (39 kilns) at the cement plants was 23,792,000 barrels, a 2,256,000-barrel increase over 1958. Of the capacity, 58 percent was by the wet process and 42 percent by the dry process. The plants reported consuming 420 million kw.-hr. of electrical energy of which 337 million kw.-hr. was purchased from public utility companies.

Alpha Portland Cement Co. completed construction of additional silos capable of storing 100,000 barrels of finished cement at its Jamesville (Onondaga County) plant. The $850,000 improvement permitted the company to store four different types of cement in each silo and to load by gravity.

At the Greenport (Columbia County) plant of Lone Star Cement Co., a bulk truck-loading station was installed during the year. In May the Akron (Erie County) plant of Louisville Cement Co. was closed, and the equipment was sold.

Lehigh Portland Cement Co. announced plans for modernizing its plant at Alsen. The $7.5 million improvement was to include a large kiln to replace four obsolete ones, a finishing mill, and 20 silos with a storage capacity of 10,000 barrels of cement each.

The Flintkote Co., building-materials producer, acquired the Glens Falls plant of Glens Falls Portland Cement Co. during the year.

Clays.—Output of clays (all miscellaneous clay and shale) increased 21 percent during the year, mainly because of a greater demand for clay and shale used in manufacturing building brick and cement. Increased demand for clays in lightweight aggregates, pottery, stoneware, and artificial abrasives also was reported for the year. In 1959, 20 pits in 10 counties were active; the bulk of the production was centered in Albany, Ulster, Orange, and Onondaga Counties.

Emery.—Output of emery from three open-pit mines in Westchester County increased, and New York continued to be the only domestic source of emery. Output was shipped to consumers in New York and Massachusetts for processing and use as aggregate for heavy-duty nonslip floors and for general abrasive purposes.

Garnet.—Abrasive garnet was recovered from two mines in the State, in Essex and Warren Counties. The refined garnet, (andradite) produced in Essex County was recovered as a byproduct of wollastonite mining. The garnet output of Warren County was used for manufacturing sandpaper and grinding and polishing glass.

Gem Stones.—The value of gem material and mineral specimens recovered mainly by amateur collectors remained at the same level as in the previous year. Specimens collected included garnet, tremolite, quartz, pyrrhotite, wollastonite, talc, sphalerite, and various other varieties. Essex County was the leading collecting area of gem material and mineral specimens.

Graphite (Manufactured).—Graphite was manufactured at Niagara Falls by Great Lakes Carbon Corp. and National Carbon Co., Division of Union Carbide Corp. Output was used to manufacture electrodes and lubricants and in foundry and other specialty uses.

Gypsum.—Crude gypsum was recovered from five underground mines—three in Erie County and one each in Genesee and Monroe Counties. Most of the crude output was calcined and processed at company-owned plants for use in manufacturing building materials such as plaster and gypsum lath. Some of the material was marketed as a cement retarder. Calcined gypsum was produced at plants in Bronx, Erie, Genesee, Monroe, Richmond, and Rockland Counties.

TABLE 3.—Production of crude gypsum

(Thousand short tons and thousand dollars)

Year	Active mines	Quantity	Value	Year	Active mines	Quantity	Value
1950-54 (average)	5	1,161	$3,843	1957	5	864	$3,749
1955	5	1,249	4,404	1958	5	834	3,869
1956	5	1,140	4,817	1959	5	919	4,663

Lime.—Production and value of lime increased for the second consecutive year. Output consisted primarily of quicklime but limited quantities of hydrated lime for agriculture and chemical and industrial purposes also were produced in Clinton County. Other lime-producing counties were Erie, Niagara, and Onondaga. Output from these counties consisted entirely of quicklime used in chemical and industrial applications. Ninety-three percent of the State total output was captive tonnage; the remainder was sold on the open market mainly to consumers in New York and the New England States. Limited quantities were shipped to Canada.

Magnesium Compounds.—At the end of 1958 Carborundum Metals Co., Division of the Carborundum Co., discontinued the recovery of magnesium chloride as a byproduct of zirconium production. In 1959 the company sold limited quantities of magnesium residue at its Akron (Erie County) plant. The company did not anticipate further recovery of magnesium chloride at the plant.

Nitrogen Compounds.—E. I. du Pont de Nemours & Co., Inc., and Olin-Mathieson Chemical Corp. recovered atmospheric nitrogen used for producing anhydrous ammonia at Niagara Falls, Niagara County. Output was used in manufacturing fertilizers, explosives, and in numerous other chemical and industrial applications.

Perlite.—Production of expanded perlite increased from 19,000 tons in 1958 to 21,000 tons in 1959; value increased from $897,000 to $978,000. Expanded perlite was produced at six plants—three in Erie County and one each in Bronx, Genesee, and Onondaga Counties. The expanded perlite came from crude material shipped from Western United States and was used mainly as a plaster aggregate. Quantities of expanded perlite also were used for loose-fill insulation, concrete aggregate, soil conditioning, filler, filtering, and other uses.

Salt.—Salt production continued as one of New York's major mineral industries; it ranked second in value in the Nation. Increased output of evaporated salt, rock salt, and brine was recorded for the year. Slight drops in the average value for evaporated and rock salt also were recorded. Rock salt recovered from underground mines in Livingston and Tompkins County was used principally for manufacturing chlorine and melting snow and ice on roads. The vacuum-pan process was the main method of recovering evaporated salt, which was used mostly for manufacturing chemicals. Brine, recovered in Onondaga County, was used exclusively for manufacturing chemicals. Other salt-producing counties were Schuyler and Wyoming. Most of the salt was consumed in New York and other Northeastern States. International Salt Co. closed the grainer (flake) salt pans at its Watkins Glen refinery because of decreasing demands for grainer salt. Also at the refinery, installation was started on a new line of machinery to manufacture and fill round cartons of table salt.[3]

TABLE 4.—Total salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	3, 296	$17, 562	1957	3, 691	$28, 002
1955	3, 780	25, 214	1958	3, 896	30, 609
1956	3, 873	27, 545	1959	4, 011	30, 958

Sand and Gravel.—Increased construction activity spurred the growth of the sand and gravel industry in New York in 1959. Total output increased more than 3.2 million tons over the preceding year. This was caused by increased demand for structural material. A 22-percent drop in demand for paving material was overcome by a 37-percent increase in demand for structural sand and gravel, resulting in a 12-percent overall increase in commercial operations. Output by Government-and-contractor operations increased 20 percent.

Sand was sold for seven major uses, of which only filtration and paving sand declined. Sales of all major uses of gravel, except paving material, increased during the year.

A total of 313 commercial operators (100 more than in 1958) were active. One plant produced over 2 million tons, and 4 others produced over 1 million tons of sand and gravel. In addition, 6 plants produced over 500,000 tons; 37, 100,000 to 499,999; 84, 25,000 to 99,999; and 181, less than 25,000 tons. Of the total commercial sand and gravel output, 84 percent was transported by truck, 15 percent by waterways, and 1 percent by railroad—the same as in 1958. Seventy-seven percent of the total sand and gravel output (commercial and Government-and-contractor) was washed and screened or otherwise prepared, compared with 71 percent in 1958.

Commercial sand and gravel producers were active in 52 counties, compared with 47 in 1958. Nassau, Suffolk, Erie, and Oneida Counties, in decreasing order, were the principal centers of commercial sand and gravel output in the State. Clinton County ranked first in Government-and-contractor production.

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[3] International Salt Co., 1959 Annual Report.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	5,822	$6,990	8,859	$11,001
Paving	5,621	6,922	3,630	4,160
Fill	359	208	501	313
Molding	191	667	199	774
Filtration	26	38	25	42
Other	431	365	601	532
Total	12,450	15,190	13,815	16,822
Gravel:				
Building	3,999	5,931	4,629	7,238
Paving	3,017	3,679	3,134	3,516
Railroad ballast	(1)	(1)	48	60
Fill	805	429	649	350
Other	1,075	756	1,673	1,489
Total	8,896	10,795	10,133	12,653
Undistributed [2]	77	53	44	52
Total sand and gravel	21,423	26,038	23,992	29,527
GOVERNMENT-AND-CONTRACTOR OPERATIONS [3]				
Sand:				
Building	34	29	14	12
Paving	506	288	233	126
Fill	----------	----------	993	653
Other	----------	----------	220	88
Total	540	317	1,460	879
Gravel:				
Building	215	95	58	20
Paving	2,552	1,091	2,191	848
Fill	----------	----------	238	139
Other	----------	----------	5	2
Total	2,767	1,186	2,492	1,009
Total sand and gravel	3,307	1,503	3,952	1,888
Grand total	24,730	27,541	27,944	31,415

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes engine sand, railroad ballast (1959), and data indicated by footnote 1.
[3] Includes data for State, counties, municipalities, and other government agencies.

Stone.—Increased demand for crushed stone as aggregates was the major factor contributing to the increase in total stone output, reflecting increased activity in the construction industry. Total output of stone increased 27 percent in tonnage and 22 percent in value. In addition to increased output of crushed and broken stone for concrete aggregate, demand for stone as flux, railroad balast, agstone, riprap, and other uses also increased. Stone (basalt, granite, limestone, marble, miscellaneous stone, sandstone, and slate) was produced in 39 of the State's 62 counties.

Limestone continued as the leading stone produced and consisted mainly of crushed and broken material. Limited quantities of dimension stone for construction were produced in Montgomery and Schoharie Counties. All major uses, except riprap for crushed limestone, increased in 1959. Niagara County became the leading limestone producing area in the State primarily because of construction of the Niagara Power project. Limestone was recovered from a channel being dug for the project and was crushed for use as concrete aggregate, stone sand, and dike filter material to be used in various phases of construction on the project. Over 3 million tons was recovered at the project. Other leading limestone-producing counties were Onondaga, Dutchess, and Greene Counties. Limited quantities of limestone were produced by Government-and-contractor operations in Erie, Jefferson, and Lewis Counties.

Output of basalt (traprock) increased 13 percent, owing mainly to increased demand for crushed basalt as concrete aggregate, the principal use. Rockland County was the only basalt-producing area in the State.

In terms of value, sandstone was the third ranking stone in the State in 1959 and was marketed both as dimension and crushed stone. Output of dimension sandstone totaled 44,000 tons valued at $1,228,000 and was sold mainly for sawed and dressed architectural stone, curbing, and flagging. Crushed or broken sandstone output increased and was used as riprap and concrete aggregate. Sandstone was produced in 10 counties, dimension sandstone in 9, and crushed sandstone in 3. In terms of value, Delaware and Tompkins Counties were the leading dimension-sandstone areas. Crushed or broken sandstone was produced in Broome, Greene, and Wyoming Counties.

Slate, in contrast with other stone produced in New York, declined in tonnage and value, primarily as a result of decreased demand for crushed slate for manufacturing roofing granules. A slight increase in demand for dimension slate, used mainly for roofing and flagging, was recorded. Eleven producers were active in Washington County—the center of the slate industry—compared with 10 in 1958. Slate granules were exported to Canada.

Granite, used mainly in rough construction and as architectural stone, was produced in Westchester County. Marble was produced in St. Lawrence and Westchester Counties and miscellaneous stone in Clinton County.

New York Trap Rock Corp. announced plans for constructing a marina or harbor at Verplanck—the site of a former quarry operation—to provide anchorage for approximately 300 boats from the metropolitan New York-New Jersey area. The marina would also serve as a winter storage area for the barge fleet of the company.

TABLE 6.—Crushed and broken limestone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

Use	1958		1959	
	Quantity	Value	Quantity	Value
Riprap	117	$173	109	$159
Concrete aggregate and roadstone	13,076	21,129	17,198	26,735
Fluxing stone	57	93	78	145
Agricultural	358	2,224	463	2,288
Railroad ballast	381	613	431	633
Cement and lime	3,517	3,116	5,245	4,965
Miscellaneous uses	2,540	4,150	2,176	4,169
Total	20,046	31,498	25,700	39,094

Talc.—New York was again the leading talc-producing State in 1959. Output from three underground mines in St. Lawrence County was ground at nearby company-owned mills. Ground talc was used principally in ceramics and paint manufacturing; other uses were in manufacturing paper, building materials, rubber, and floor and wall tile.

METALS

Aluminum.—The Reynolds Metals Co., which broke ground for its new aluminum facilities at Massena in June 1957, placed the first of three potlines in operation in July. The other two potlines were expected to be producing by early 1960. Each potline had 168 Soderberg pots (reduction cells) housed in six potrooms and represented about 33,000 tons of primary-reduction capacity. The entire plant, which also includes rectifiers, carbon paste and cryolite mixers, molding furnaces, cranes, and other facilities, was estimated to cost $88 million. Rail and highway transportation were used exclusively, but the company had conducted studies of the feasibility of dock and terminal construction for water transportation of its raw materials and products.

About one third of the plant's annual production was to be delivered as molten metal to a Chevrolet foundry costing $15 million being erected near the smelter. The molten metal was to be transported in crucibles by truck to the foundry. (Aluminum retains its molten state for several hours and can be cast directly into molds for automobile parts). The remainder of the metal was to be processed into pigs or ingots.

Combined capacity of Reynolds Metals Co. and Aluminum Company of America, when fully operational, would approximate 250,000 tons or about 10 percent of the total primary aluminum production capacity in the United States. The working forces of the Aluminum Company of America, Reynolds Metals Co., and the smaller industries or business interests dependent upon the aluminum industry, was approximately 5,800 employees, 60 percent of the region's employment.

Ferroalloys.—Ferroalloy production rose 24 percent, compared with 1958, and shipments increased 35 percent. Total value of shipments increased only slightly, due chiefly to a sharp decrease in output and value of ferrochrome alloys. Production and value of most ferroalloys, however, were substantially higher. Shipments of silvery pig iron more than doubled, and those of ferromanganese more than tripled, compared with 1958. Production and shipments consisted of 15 principal classifications of ferroalloys and included, in addition to those mentioned above, silicomanganese, ferrosilicon, ferrotitanium, ferrocarbon-titanium, ferrotungsten, ferrocolumbium, ferrotantalum-columbium, ferrovanadium, and other alloys.

In response to higher strategic demand, production facilities for manufacturing high-purity ductile vanadium metal were tripled by the Fine Metals and Chemicals Department (Niagara Falls) of the Union Carbide Metals Co., Division of Union Carbide Corp. Development of a new supermagnetic alloy, a new titanium-vanadium alloy, and nuclear energy uses were claimed to be the chief causes of this rise in demand.

TABLE 7.—Producers of ferroalloys in 1959

Company	Location	Type of furnace	Ferroalloys produced [1]
Hanna Furnace Corp	Erie County, Buffalo	Blast	Silvery pig iron.
Pittsburgh Metallurgical Co	Niagara County, Niagara Falls.	Electric	FeMn, SiMn, FeSi, FeCr, silvery pig iron.
Titanium Alloy Mfg. Div. of National Lead Co.	do	do	FeTi, FeB, FeZr, other miscellaneous ferroalloys.
Union Carbide Metals Co	do	do	FeMn, FeCr, FeTi, FeW, FeB, FeCb, FeCbTa, SiMn.
Vanadium Corp. of America	do	do	FeMn, FeSi, FeCr, FeTi, other miscellaneous ferroalloys.
Transition Metals & Chemical Co.	Ulster County, Wallkill	Thermit	FeCb.

[1] Symbols: FeMn, ferromanganese; SiMn, silicomanganese; FeSi, ferrosilicon; FeCr, ferrochromium; FeTi, ferrotitanium; FeW, ferrotungsten; FeB, ferroboron; FeCb, ferrocolumbium; FeCbTa, ferrocolumbium-tantalum; FeZr, ferrozirconium.

Iron and Steel.—One firm reported a small gain in blast-furnace capacity. Five firms operated blast furnaces: there were 17 stacks at 6 plants—one was out of blast the entire year. Four plants were in Erie County, one in Niagara County, and one in eastern New York in Rensselaer County. Capacity of the nine plants in New York producing ingots and steel for castings decreased slightly, according to the American Iron and Steel Institute. All open-hearth furnaces were in Erie County. The electric furnaces were in different counties—one in the east, two in the middle section of the State, and three in the extreme western counties. There were 75 furnaces in operation, with a total capacity of nearly 7.5 million tons.

TABLE 8.—Annual capacities of blast furnaces, January 1, 1960

[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (thousand short tons)
	Erie County:		
Hanna Furnace Corp	Buffalo	4	850
Republic Steel Corp	do	2	683
Bethlehem Steel Co	Lackawanna	7	3,590
Colorado Fuel & Iron Corp	Tonawanda	2	396
Tonawanda Iron Division, American Radiator & Standard Sanitary Corp.	Niagara County: North Tonawanda	1	165
Republic Steel Corp	Rensselaer County: Troy	1	263
Total		17	5,947

Iron Ore.—Production of iron ore rose 5 percent, to over 2 million long tons in spite of a 116-day steel strike. The ore mined was magnetite except for a small quantity of hematite for use as pigment. Agglomerated material, especially sinter, was the chief type of ore shipped, followed by concentrate and some direct-shipping ore. Three firms operating five mines produced magnetite, and one firm with one mine, hematite. Of the five active magnetite mines, three were in Essex County, and one each in Clinton and St. Lawrence Counties. The hematite was mined in Oneida County. Most of the magnetite was taken from open-pit mines. The hematite, from underground mines, was concentrated by agglomeration, spiraling, jigging, and magnetic separation.

TABLE 9.—Annual steel capacity (ingots and steel for castings) as of January 1, 1960 [1]

[American Iron and Steel Institute]

Type of furnace and company	Location of plant	Number of furnaces	Total annual capacity (short tons)
OPEN HEARTH			
	Erie County:		
Republic Steel Corp	Buffalo	9	900,000
Bethlehem Steel Co	Lackawanna	35	6,000,000
Colorado Fuel & Iron Corp	Tonawanda	3	295,000
Total		47	7,195,000
ELECTRIC			
Allegheny Ludlum Steel Corp	Albany County: Watervliet	7	76,300
Do	Chautauqua County: Dunkirk	3	33,000
Wickwire Brothers, Inc	Cortland County: Cortland	2	28,730
Allegheny Ludlum Steel Corp	Erie County: Tonawanda	2	4,000
Simonds Saw & Steel Co	Niagara County: Lockport	3	21,600
Crucible Steel Co of America	Onondaga County: Syracuse	11	61,380
Total		28	225,010
Grand total		75	7,420,010

[1] Capacities of foundries that normally produce steel only for castings are not included.

Lead.—Output of recoverable lead dropped 17 percent in tonnage and 18 percent in value to the lowest point in over 30 years, because of a 4-month work stoppage. The Balmat mine, St. Lawrence County, was the only lead producer in New York.

TABLE 10.—Mine production of silver, lead and zinc, in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Silver		Lead		Zinc		Total value (thousands)
			Fine ounces	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	2	548,233	37,813	$34	1,345	$396	43,147	$11,928	$12,358
1955		650,877	66,162	60	1,037	309	53,016	13,042	13,411
1956		657,445	84,158	76	1,608	505	59,111	16,196	16,777
1957		660,638	63,880	58	1,667	477	64,659	15,001	15,536
1958		563,644	66,738	60	579	136	53,014	10,815	11,011
1959		438,769	51,588	47	481	111	43,464	9,997	10,155

TABLE 11.—Mine production of silver, lead, and zinc in 1959, by months, in terms of recoverable metals

Month	Silver (fine ounces)	Lead (short tons)	Zinc (short tons)	Month	Silver (fine ounces)	Lead (short tons)	Zinc (short tons)
January	6,724	71	5,259	August	(1)	(1)	(1)
February	7,511	56	5,307	September	(1)	(1)	(1)
March	7,753	54	5,613	October	(1)	(1)	(1)
April	7,409	70	5,458	November	-------	69	4,460
May	7,713	51	5,729	December	7,344	68	6,496
June	7,134	42	5,142				
July	(1)	(1)	(1)	Total	51,588	481	43,464

[1] No production due to labor dispute.

Silver.—Recoverable silver was obtained as a byproduct of the concentration of zinc-lead ore from the Balmat mine, St. Lawrence County. Production of silver dropped in proportion to zinc and lead output because of a strike at the Balmat mine.

Titanium Concentrate (Ilmenite).—The value of shipments of ilmenite increased slightly in 1959. Ilmenite was separated from the titaniferous magnetite ore body at Tahawus in Essex County by National Lead Co. in a nearby mill. The material was used mostly for pigments.

Zinc.—New York declined to third place in zinc-producing States, behind Tennessee and Idaho, as a result of a 4-month strike. Output of recoverable zinc dropped to the lowest level since 1952. The Balmat and Edwards mines in southern St. Lawrence County were the only producers.

Zirconium.—Zirconium-sponge metal was produced at the Akron (Erie County) plant of Carborundum Metals Corp., Division of Carborundum Co.

MINERAL FUELS

Coke and Coal Chemicals.—Although production of coke rose to more than 3 million short tons, New York dropped to seventh among coke-producing States (sixth in 1958). Value of the coke output rose to $51.5 million. Both quantity and value, however, were much less than in 1957. The average value per ton ($16.91) remained below the national average ($17.82). Nearly 4.4 million tons of coal was carbonized in making the 3 million tons of coke. Of 4.2 million tons of coking coal delivered to the coke-oven plants in 1959, Pennsylvania supplied 54 percent, West Virginia 24 percent, Virginia 15 percent, and Kentucky 7 percent. Compared with 1958 receipts, Pennsylvania deliveries declined 18 percent, and receipts from Kentucky, West Virginia, and Virginia increased 23, 18, and 25 percent, respectively. Nearly two-thirds (64 percent) of the coal received was high-volatile coal, 25 percent low-volatile, and 11 percent medium-volatile.

Output of coke and coal chemicals in New York was confined entirely to Erie County, where one merchant and two furnace plants were operated at Buffalo and Lackawanna. In response to increased demand for blast-furnace fuel, Bethlehem Steel Co. planned to add 76 new slot-type coke ovens to its Lackawanna plant, thereby adding 500,000 tons to the plant's annual capacity of more than 2.5 million tons.

Eighty-one percent of the coke produced was used by the producing company for blast-furnace operations and other purposes. The remainder represented commercial sales for blast-furnace, foundry, and other industrial uses, and for residential heating. Byproducts recovered at coke plants included 225,000 tons of coke breeze, of which 70 percent was consumed in the producer's own steam plants. Other byproducts recovered were coke-oven gas (41,943 million cubic feet), ammonium sulfate (40,125 tons), ammonium liquor (NH_3 content, 1,991 tons), coke-oven tar (35.6 million gallons), and crude light oil (13.6 million gallons). Products derived from the light oil were benzene (11.8 million gallons), toluene (2.6 million gallons), xylene (609,000 gallons), and solvent naphtha (67,000 gallons).

TABLE 12.—Number, type and capacities of coke-oven plants as of December 31, 1959

Company	Location	Classification of plant	Number and type of ovens	Annual coke capacity (thousand short tons)
Allied Chemical Corp	Erie County: Buffalo	Merchant	120 Semet-Solvay	900
Bethlehem Steel Co	Lackawanna	Furnace	171 Koppers-Becker 60 Semet-Solvay 228 Wilputte	2, 514
Donner-Hanna Coke Corp	Buffalo	do	186 Koppers 66 Koppers-Becker	1, 169

Fuel Briquets and Packaged Fuel.—Consumption of fuel briquets in New York was 98 short tons, down from 3,241 tons in 1958. The 1958 figure was less than one half of 1 percent of total United States shipments. Exports of fuel briquets through the Buffalo customs district, mostly to Canada, dropped from 34,219 tons in 1957 and 22,408 tons in 1958 to 1,825 tons in 1959. Exports in 1959 were 95 percent below those of 1957. Exports from the St. Lawrence customs district decreased from 15,308 tons in 1957 to 7,350 tons in 1958 to 2,429 tons in 1959. These decreases were much greater than the 61-percent decline in total United States exports since 1957.

Natural Gas.—Production of natural gas rose more than 40 percent to 4,000 million cubic feet valued at more than $1.3 million, according to preliminary 1959 figures. Distribution output was largely from the Oriskany and Medina sandstones. Production from the Medina horizon rose nearly 1 billion compared with 1958. Twenty-three wells were drilled to the Medina formation, and 15 to the Oriskany.

According to the American Gas Association, the proved reserve of natural gas at the end of 1959 totaled 106,519 million cubic feet, more than 10 billion cubic feet greater than in 1958, due largely to extensions and revisions in existing gasfields and to increased quantities in underground storage, compared with the previous year. Of the total reserve, more than half was in underground reservoirs for storage purposes.

Deep exploration and leasing activities by the major oil and gas companies continued, and large acreages were taken up, particularly in the central and southern parts of the State. Of particular interest was a recently published compilation of natural-gas wells drilled to the Lower Devonian Oriskany horizon or deeper. It included detailed data on location, drilling conditions, formations, depth, and results for nearly 900 wells completed on or before January 1, 1957.

Information was presented on all known exploratory wells drilled outside of gas-producing or storage fields, plus selected wells outlining the fields. Included also were descriptions of wells drilled in some Pennsylvania counties adjacent to New York gasfields.[4]

Peat.—Peat production in 1959 dropped somewhat, although output value rose 18 percent. Three producers were active, one each in Orange, Seneca, and Westchester Counties. Sales of peat totaled 11,566 short tons and were largely (87 percent) bulk sales. The remainder was packaged before sale and sold at nearly three times the value of bulk sales.

Petroleum.—Output of petroleum increased 12 percent in quantity and 13 percent in value over 1958 but was the lowest quantity since 1925 and the lowest value since 1933. The production increase was mostly due to the removal of the voluntary proration of output imposed by the producers because of the closing of the Wellsville refinery of the Sinclair Refining Co. New York crude oil in 1959 was processed at refineries in Pennsylvania near Bradford, Farmers Valley, and Rouseville. Production principally was obtained from Allegany, Steuben, and Cattaraugus Counties in southwestern New York.

The posted price of New York-Pennsylvania crude oil January 1, 1959, was $4.05 per barrel. Its price rose to $4.15 April 1, $4.25 May 1, and $4.40 September 12, where it remained to yearend. The established average price for the year was $4.24. Producers in Allegany County, however, received 8 cents less than the posted price per barrel.

According to the American Petroleum Institute, the proved reserve of crude petroleum as of December 31, 1959, totaled 34.2 million barrels. Production, however, considerably exceeded the 360,000-barrel addition to the reserve during the year, and the proved reserve was reduced by more than 1½ million barrels from the figure reported at the end of 1958. New York ranked 23d in quantity of proved crude oil reserves among oil-producing States in both 1958 and 1959. Total drilling footage for field and wildcat wells was nearly 834,000 feet for 544 well completions. These figures include statistics for crude oil, gas, dry, and service wells.

TABLE 13.—Production and value of crude oil.

Year	Thousand barrels	Value (thousands)	Average value per barrel	Year	Thousand barrels	Value (thousands)	Average value per barrel
1950-54 (average)	3,939	$15,798	$4.01	1957	2,677	$12,662	$4.73
1955	2,904	10,310	3.55	1958	1,763	7,457	4.23
1956	2,748	12,091	4.40	1959[1]	1,981	8,399	4.24

[1] Preliminary figures.

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[4] Kreidler, W. (William) Lynn, Selected Deep Wells and Areas of Gas Production in Eastern and Central New York: New York State Museum and Science Service-Geol. Survey Bull. 373, Albany, N.Y., 1959, 243 pp.

TABLE 14.—Capacity of petroleum refineries and cracking plants in New York, as of January 1, 1959

(Barrels per day)

County and company	Location	Type of plant	Crude-oil capacity			Cracked-gasoline capacity, operating
			Operating	Shut down	Building	
Erie County:						
Frontier Oil Refining Corp., Division of Ashland Oil & Refining Co.	Tonawanda	Skimming, cracking, asphalt.	30,000	--------	--------	12,500
Mobil Oil Co.	Buffalo	Complete	26,000	--------	2,500	12,400
Queens County: Mobil Oil Co.	Brooklyn	do	30,500	--------	--------	5,500
Richmond County: Gulf Oil Co.	Gulfport	Skimming	--------	17,000	--------	--------
Total			86,500	17,000	2,500	30,400

TABLE 15.—Well completions and drilling footage for field wells and wildcats, 1959 [1]

Type of well	Field wells		Wildcats		Total	
	Well completions	Drilling footage	Well completions	Drilling footage	Well completions	Drilling footage
Crude	144	183,024	--------	--------	144	183,024
Gas	7	18,957	1	3,299	8	22,256
Dry	6	5,600	21	99,357	27	104,957
Service	80	109,040	--------	--------	80	109,040
Total	237	316,621	22	102,656	259	419,277

[1] Oil and Gas Journal, Annual Review Issue: Vol. 58, No. 4, Jan. 25, 1960.

TABLE 16.—Production of sand and gravel by Government-and-contractor operations, by counties, in short tons

County	1958	1959	County	1958	1959
Albany	211,410	418,591	Montgomery	2,484	10,324
Allegany	44,623	--------	Niagara	--------	19,999
Cattaraugus	--------	54,300	Oneida	47,250	135,000
Cayuga	7,380	810	Onondaga	75,689	--------
Chautauqua	641,079	229,977	Ontario	1,054	34,700
Chemung	--------	3,420	Orange	85,680	119,375
Clinton	78,809	627,117	Orleans	15,258	12,566
Cortland	8,375	5,145	Oswego	37,800	41,850
Delaware	5,000	23,400	Otsego	20,250	32,500
Dutchess	20,349	11,400	Rensselaer	141,357	50,585
Erie	461,960	165,438	St. Lawrence	278,341	232,312
Essex	18,805	56,087	Saratoga	262,546	452,008
Franklin	181,773	182,941	Schenectady	97,624	138,686
Fulton	11,726	770	Schuyler	35,723	43,068
Genesee	29,718	32,010	Steuben	--------	194,872
Greene	3,746	35,025	Suffolk	39,982	41,865
Hamilton	--------	21,000	Warren	31,590	81,182
Herkimer	26,112	24,527	Washington	37,482	176,595
Jefferson	186,115	23,603	Wayne	28,976	31,971
Lewis	8,248	63,467	Yates	78,300	58,000
Livingston	40,000	65,150			
Monroe	4,452	--------	Total	3,307,066	3,951,636

REVIEW BY COUNTIES

Mineral output was reported from all counties except the five counties in New York City. Value of mineral output was higher in 43 of the 57 mineral-producing counties. The largest increase in total dollars was in Ulster County, owing to the addition of a new cement plant. The leading centers of mineral activity, in decreasing order of value, were St. Lawrence, Erie, Greene, Onandaga, and Essex Counties.

TABLE 17.—Value of mineral production in New York, by counties[1][2][3]

County	1958	1959	Minerals produced in 1959 in order of value
Albany	(4)	(4)	Stone, sand and gravel, clays.
Allegany	$359,422	$733,266	Sand and gravel.
Broome	(4)	(4)	Sand and gravel, stone, clays.
Cattaraugus	829,312	763,721	Sand and gravel.
Cayuga	(4)	(4)	Stone, sand and gravel.
Chautauqua	444,155	275,943	Sand and gravel.
Chemung	(4)	(4)	Sand and gravel, clays.
Chenango	150,020	147,447	Sand and gravel.
Clinton	(4)	(4)	Iron ore, lime, sand and gravel, stone.
Columbia	(4)	(4)	Cement, sand and gravel, stone.
Cortland	111,431	142,996	Sand and gravel.
Delaware	758,229	727,467	Stone, sand and gravel.
Dutchess	(4)	(4)	Stone, sand and gravel, clays.
Erie	19,091,801	22,287,034	Cement, gypsum, stone, sand and gravel, lime, clays.
Essex	(4)	(4)	Iron ore, titanium concentrate, wollastonite, sand and gravel, garnet, gem stones.
Franklin	192,782	250,732	Sand and gravel, stone.
Fulton	61,364	90,585	Sand and gravel.
Genesee	(4)	(4)	Gypsum, stone, sand and gravel.
Greene	(4)	(4)	Cement, stone, sand and gravel.
Hamilton	------	28,858	Sand and gravel.
Herkimer	(4)	(4)	Stone, sand and gravel, gem stones.
Jefferson	(4)	(4)	Do.
Lewis	(4)	(4)	Stone, sand and gravel.
Livingston	(4)	(4)	Salt, sand and gravel, stone.
Madison	338,481	433,699	Stone, sand and gravel.
Monroe	2,633,130	2,995,933	Stone, sand and gravel, gypsum.
Montgomery	424,756	(4)	Stone, sand and gravel.
Nassau	6,337,330	7,674,693	Sand and gravel, clays.
Niagara	(4)	8,581,940	Stone, lime, sand and gravel.
Oneida	1,630,230	2,971,509	Stone, sand and gravel, iron ore (pigment material).
Onondaga	12,580,611	(4)	Lime, salt, cement, stone, sand and gravel, clays.
Ontario	(4)	(4)	Stone, sand and gravel.
Orange	(4)	1,630,244	Sand and gravel, stone, clays, peat.
Orleans	(4)	(4)	Stone, sand and gravel.
Oswego	(4)	(4)	Sand and gravel.
Otsego	(4)	(4)	Stone, sand and gravel.
Putnam	31	(4)	Do.
Rensselaer	(4)	(4)	Stone, sand and gravel, clays.
Rockland	(4)	(4)	Stone, sand and gravel.
St. Lawrence	30,929,412	27,678,013	Iron ore, zinc, talc, stone, sand and gravel, lead, silver, gem stones.
Saratoga	(4)	(4)	Sand and gravel, stone.
Schenectady	(4)	445,329	Sand and gravel.
Schoharie	(4)	(4)	Cement, stone.
Schuyler	(4)	(4)	Salt, sand and gravel.
Seneca	(4)	(4)	Peat.
Steuben	(4)	533,762	Sand and gravel.
Suffolk	5,651,386	6,440,796	Do.
Sullivan	235,000	(4)	Sand and gravel, stone.
Tioga	(4)	(4)	Sand and gravel.
Tompkins	(4)	(4)	Salt, sand and gravel, stone.
Ulster	(4)	(4)	Cement, stone, clays, sand and gravel.
Warren	(4)	(4)	Cement, garnet, stone, sand and gravel, gem stones.
Washington	801,466	891,704	Stone, sand and gravel.
Wayne	(4)	(4)	Do.
Westchester	(4)	765,100	Stone, emery, sand and gravel, peat.
Wyoming	(4)	(4)	Salt, stone, sand and gravel.
Yates	27,406	20,300	Sand and gravel.
Undistributed[5]	121,750,325	148,607,972	
Total	205,338,000	235,119,000	

[1] Bronx, Kings, New York, Queens, and Richmond Counties are not listed because no production was reported.

[2] Fuels, including natural gas and petroleum, not listed by counties, value is included with "Undistributed."

[3] Excludes value of clays and stone used in manufacturing lime and cement.

[4] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[5] Includes values of items not specified by counties and data indicated by footnote 4.

Albany.—Callanan Road Improvement Co. (South Bethlehem) produced limestone for riprap, blast-furnace flux, concrete aggregate, railroad ballast, and agriculture. A limited quantity of dimension sandstone, used for flagging and rough-dressed construction work, was produced at East Berne by Heldeberg Bluestone & Marble, Inc. Sand and gravel, used mainly for building and paving, was recovered from pits near Albany, Bethlehem, South Bethlehem, Selkirk, Cedar Hill, and Loudonville. Albany Gravel Co., Inc., was the leading producer. Whitehead Bros. produced prepared molding sand from pits at Selkirk and Slingerland.

The county continued as the leading clay-producing area in the State. Production of miscellaneous clay increased to 250,000 short tons from 180,000 tons in 1958. Powell and Minnock Brick Works, Inc., Sutton & Suderly Brick Co., and Roah Hook Brick Co., all near Coeymans, mined miscellaneous clay for use in manufacturing building brick. Northern Lightweight Aggregates, Inc., produced expanded shale lightweight aggregate (Norlite) by the rotary kiln process at Cohoes. Artificial abrasives, pottery, and flowerpots were produced from clay mined near Albany by Rex Clay Products Co., Inc.

Allegany.—Building and paving sand and gravel were recovered from pits near Alfred, Belmont, and Friendship.

Bronx.—Crude gypsum was calcined by the kettle process at the Bronx plant of the National Gypsum Co. At the plant, the company also expanded perlite shipped from Colorado. The expanded perlite was used in building plaster.

Broome.—Sand and gravel, mainly building and paving material, was produced by Binghamton Crushed Stone & Gravel Co., Inc., at Binghamton, and by Barney and Dickenson, Inc., and Winne & Son, Inc., both near Vestal. M. R. Corbisello, Inc. (formerly Corbisello Quarries) produced sandstone for riprap and concrete aggregate near Binghamton. Dimension bluestone (sandstone) was quarried at unspecified locations in the county and shipped to yards in Delaware County for fabricating into flagstone. Binghamton Brick Co., Inc. (Binghamton) mined miscellaneous clay for manufacturing building brick.

Cattaraugus.—Production of sand and gravel totaled 626,000 tons, a 17-percent decrease from 1958. Output, mainly building and paving material, came from Allegany, Franklinville, Gowanda, Limesetone, Onoville, and Red House.

Cayuga.—Limestone for concrete aggregate, roadstone, railroad ballast, riprap, and asphalt filler was quarried and crushed near Auburn by General Crushed Stone Co. Sand and gravel, mainly prepared material, was produced at Auburn by Jay W. Robinson & Son and J. J. Harrington.

Chautauqua.—Commercial sand and gravel output of 114,000 tons in 1959, mainly building and paving material, came from pits near Jamestown, Bemus Point, and Dunkirk.

Chemung.—Sand and gravel used chiefly for building and paving was produced by Dalrymple Gravel and Contracting Co., Inc. (Elmira), and Elmira Transit Mix, Inc. (Horseheads). Consolidated Brick Co. (Horseheads) mined miscellaneous clay for manufacturing building brick.

Chenango.—Bundy Concrete Co. (Sherburne) and B&B Builder Supplies (Greene) were the leading producers of sand and gravel in the county. Output consisted mainly of building material.

Clinton.—Republic Steel Corp. mined magnetic iron ore at its Chateaugay underground and open-pit mine near Dannemora. Concentrate and sinter (produced on Dwight-Lloyd sintering machines) were consumed in making pig iron and steel. Underground mining was almost entirely by sublevel stoping. Multiple benches were employed in the open-pit section of the mine. The company also recovered gneiss (miscellaneous stone) from waste building material for use as concrete aggregate, railroad ballast, and stone sand.

International Lime & Stone Corp. quarried limestone near Chazy for use as riprap, blast-furnace and open-hearth flux, concrete aggregate and agstone, and for manufacturing lime at its nearby plant. Quicklime and hydrated lime were produced at the Chazy plant in two shaft kilns and a batch hydrator. Bituminous coal and producer gas were utilized for fuel. The lime was sold for use in the construction and chemical industries and in agriculture in New York, the New England States, and Canada. Lancaster Development Corp. also quarried limestone near Plattsburg for concrete aggregate and roadstone.

Bero Construction Corp. (Morrisonville) resumed production of building and paving sand and gravel in 1959 after being idle in 1958.

Columbia.—Columbia County dropped from the first-ranking cement-producing county in 1958 to third in 1959. Portland and masonry cements were produced by Lone Star Cement Corp. (Greenport) and Universal Atlas Cement Division of United States Steel Corp. (Hudson). At the Greenport plant, a bulk truck-loading station was installed during the year. Limestone quarried nearby was the chief raw material used in production of cement. Quantities of clay, shale, and gypsum also were used as raw materials. The bulk of the cement was consumed in New York, but quantities also were shipped to New Jersey and New England. Limestone for concrete aggregate roadstone was produced at the Hudson quarry of Catskill Mountain Stone Corp. During the year, sand and gravel producers were active at Claverack, Hillsdale, Hudson, and Livingston.

Cortland.—Ready-Mix Concrete Co. (Cortland) produced building, paving, and other sand and gravel.

Delaware.—Delaware County continued to lead in production and value of sandstone (bluestone). Output totaled 30,000 tons, valued at $718,000—a 5-percent decline in value from 1958. Output consisted entirely of dimension stone for construction and architectural purposes, curbing and flagging. Fabricating yards in the county dressed and processed stone quarried in Delaware, surrounding New York counties, and Wayne County, Pa. Producers were W. R. Strong & Son and Willis Hankins (both near Deposit), Johnston & Rhodes Bluestone Co. (East Branch), Paul Thompkins Estate (Hancock), and American Bluestone Co. (Masonville). The dimension stone was used in constructing schools, churches, hospitals, and other buildings in New York, Connecticut, and Washington, D.C. Limited quantities of gravel were produced at unspecified locations in the county.

Dutchess.—The county ranked first in the value of commercial limestone produced in 1959. Limestone quarried mainly for concrete aggregate and roadstone was produced by New York Traprock Corp. (New Hamburg) and Dutchess Quarry & Supply Co., Inc. (Pleasant Valley). The Clinton Point quarry (New Hamburg), of New York Trap Rock Corp., was cited by the Federal Bureau of Mines for working 340,112 man-hours without a lost-time injury in 1959. The quarry ranked third in its group in the National Safety Competition. Commercial production of sand and gravel totaled 423,000 tons— a 13-percent increase over 1958. Building and paving material was recovered from 13 operations throughout the county. Miscellaneous clay, used mainly for manufacturing building brick, was produced near Beacon by Dennings Point Brick Works, Inc.

Erie.—The county ranked second in total mineral value and in cement production. Lehigh Portland Cement Co. and Penn-Dixie Cement Corp., both near Buffalo, produced portland and masonry cements. Masonry cement was produced near Akron by Louisville Cement Co. Raw materials used at the cement plants included limestone, shale, clay, gypsum, sand, iron ore, mill scale, and pyrite sinter. Most of the portland and masonry cements were consumed in New York and Pennsylvania. In May the Akron plant of Louisville Cement Co. was closed, and most of the equipment sold.

Crude gypsum was recovered from three underground mines in the county. Universal Atlas Cement Co. mined gypsum at Clarence Center for use as a portland cement retarder. Crude gypsum was mined near Clarence by Bestwall Gypsum Co. and shipped to the company-owned plant at Akron, where it was calcined and made into finished building materials. In addition, crude perlite from Nevada and Colorado was expanded at the Akron plant. National Gypsum Co. mined and calcined gypsum and processed crude perlite at its Clarence Center plant. Crude perlite shipped from Western states was expanded by Buffalo Perlite Corp. at Cheektowaga. The expanded perlite was used mainly as a plaster aggregate; quantities also were used for loose-fill insulation, concrete aggregate, soil conditioning, filler, and filter purposes.

Limestone was produced by County Limestone Co., Inc. (Akron), Buffalo Stone Corp. (Bowmansville), Federal Crushed Stone Corp. (Cheektowaga), and Lancaster Stone Products Corp. (Lancaster). Most of the crushed limestone was used for concrete aggregate, roadstone, and riprap. The county continued to rank third in value of commercial sand and gravel output. Production totaled 1.7 million tons, an 18-percent decline from 1958. Sixty-eight percent of the sand and gravel produced was prepared material, and all was shipped by truck. Nine principal producers were active during the year. Quicklime was produced for metallurgical purposes at the Buffalo plant of Kelley Island New York Corp. The plant was awarded a Certificate of Achievement in Safety in Group C (calcining plants only) of the National Lime Association Safety Competition for working 49,425 man-hours without a disabling injury. Miscellaneous clay used principally for manufacturing building brick was mined and processed near Lakeview and Orchard Park. Anchor Concrete Products, Inc. (Jewettsville) mined and processed miscellaneous clay in a rotary kiln for expanded lightweight aggregate. A limited quantity of clay for manufacturing flowerpots was mined near Buffalo.

Essex.—Magnetite was mined at the Old Bed-Harmony and Fisher Hill open-pit mines of the Republic Steel Corp. at Moriah, near Mine-ville, and the MacIntyre underground mine of the National Lead Co. at Tahawus. Direct-shipping ore, concentrate, and sinter from these mines were used primarily for making pig iron and steel, and to a lesser extent in cement, for heavy-medium separation, and other uses. The second largest iron ore mine in New York was in Essex County. Titaniferous magnetite also was mined at Tahawus, with recovery of sizable tonnages of ilmenite. The concentration and sintering plant treating this mine product included the following operations: crushing, grinding, screening, gravity separation (heavy medium), flotation, magnetic separation, and sintering. Mining for titaniferous magnetite at the Old Bed-Harmony mine was mined by sublevel stoping (90 percent) and use of casual pillars (10 percent). Mining for titaniferous magnetite at the Fisher Hill was by room and pillar. The magnetic separation and sintering plant treated ore from both mines. Milling operations consisted of crushing, screening, grinding, magnetic concentration, sintering, and pelletizing.

Wollastonite and byproduct abrasive garnet (andradite) were recovered at the Willsboro mine of Cabot Carbon Co. The wollastonite was crushed and ground for use as a filler in paints, ceramics, and plastics. Sand and gravel was produced near Elizabethtown and Saranac Lake. Output consisted mainly of prepared material. Specimens of wollastonite, colophonite, pyrrhotite, biotite mica, and diopside were collected as gem material in the county.

Franklin.—Sand and gravel consisting mainly of bank-run material was produced from pits near Bombay, Malone, St. Regis Falls, and Westville. Rough construction sandstone used on the Cartier Bridge, Montreal, Canada, was quarried near Malone by Adirondack Stone Quarries, Inc. Dressed architectural sandstone was quarried and fabricated at the Burke plant of Franklin-Clinton Sandstone Co., Inc.

Fulton.—Commercial production of sand and gravel totaled 73,000 tons, a 58-percent increase over 1958. Output came from seven principal producers and consisted mainly of building and paving material.

Genesee.—Crude and calcined gypsum was produced near Oakfield by United States Gypsum Co. The company also expanded perlite. Crushed limestone used mainly for concrete aggregate, roadstone, railroad ballast, and riprap was produced at quarries near Le Roy, North Le Roy, and Stafford. Sand and gravel used chiefly for structural purposes was produced by Frey Sand & Gravel Corp. (Alexander), Batavia Washed Sand & Gravel Co., Inc., Western New York Gravel & Concrete Corp., and B. R. DeWitt, Inc., all near Batavia.

Greene.—The county ranked first in value of cement in 1959. Portland and masonry cements were produced by Alpha Portland Cement Co. (Cementon), and Lehigh Portland Cement Co. and North American Cement Corp. (near Alsen). These companies also quarried limestone nearby as the main raw material. In addition they used clay, gypsum, iron ore, mill scale, and pyrite cinders as raw materials for cement. Most of the cement output was consumed in the New England States. A small quantity was exported. Catskill Mountains Stone Corp. produced crushed sandstone for concrete aggregate and roadstone near Cairo. Two principal sand producers were active: Whitehead Bros. Co. produced prepared molding sand at pits near Catskill, and Coxsackie, and Bert Lawrence produced unprepared sand for use on icy highways at Ashland.

Hamilton.—Limited quantities of sand and gravel were recovered from commercial operations in the county.

Herkimer.—Limestone for concrete aggregate, agstone, and asphalt filler was quarried near Jordanville by General Crushed Stone Co. The limestone quarry of Newport Quarries Corp. (Newport) did not operate in 1959. F. J. Steber produced structural sand and fill gravel near Poland. Mineral specimens of quartz crystals were recovered near Herkimer, Little Falls, and Middleville.

Jefferson.—General Crushed Stone Co. (Watertown) quarried limestone for use as agstone and for highway and railroad construction and maintenance. The highway departments of the towns of Cape Vincent and Lynn produced limestone from concrete aggregate and roadstone. Dimension sandstone for rough construction and for flagging was produced near Redwood by Multi-Color Sandstone Co. Sand and gravel production totaled 150,000 tons, a slight increase over 1958. Output came principally from six producers near Adams, Burrville, Elisburg, and Watertown. One hundred pounds of tremolite was collected near Natural Bridge by an amateur gem and mineral collector.

Lewis.—Carbola Chemical Co., Inc., quarried and crushed low-magnesium limestone for filler in paper, soap, and insecticides, and for other uses. The highway department of the town of Lowville produced limestone for concrete aggregate and roadstone.

Livingston.—The States leading salt-producing area was the Retsof underground mine of International Salt Co. Development of the mine was by room and pillar. Rock salt was used mainly in manufacturing chemicals and for controlling ice on highways. Most of the salt was shipped to markets in New York and other Northeastern States; some was exported to Canada and Pakistan. Sand and gravel was produced at pits near Avon, Conesus, Scottsville, and West Sparta. Limestone used for concrete aggregate and roadstone was quarried near Rochester.

Madison.—Munnsville Limestone Corp. (Munnsville) and Worlock Stone Co., Inc. (Perryville) quarried and crushed limestone mainly for concrete aggregate, roadstone, and agstone. Principal production of commercial sand and gravel was near Hamilton.

Monroe.—Crushed sandstone used mainly for concrete aggregate and roadstone was produced from quarries near Brockport, Gates, and Penfield. Commercial production of sand and gravel increased 35 percent and consisted mainly of building and paving material. Principal production came from operations near Mendon, Penfield, Pittsford, Scottsville, and Spencerport. All output was shipped to consumers by truck. Finished gypsum building products were produced at the Caledonia plant of the Ruberoid Co. from crude material recovered at the nearby Wheatland mine.

Montgomery.—Crushed Rock Products, Inc., and Cushing Stone Co., Inc., quarried limestone near Amsterdam, for use mainly in road construction. St. Johnsville Supply Co., Inc. (St. Johnsville) was the principal commercial sand and gravel producer. All output was washed, screened, or otherwise prepared, and consisted chiefly of building and paving material.

Nassau.—The county continued to rank second among the State's sand and gravel-producing counties. Output increased to 5.6 million tons compared with 4.8 million tons in 1958. Value increased 21 percent over the preceding year. Nearly all prepared building and paving material was produced at seven operations. Trucks and barges were used to transport the material. Miscellaneous clay used in manufacturing building brick was mined from a pit near Farmingdale by Nassau Brick, Inc.

Niagara.—Limestone production increased sharply, owing to the construction of the $700 million Niagara Power project. To meet demands of aggregate for the project, a plant with a capacity of 2,000 tons of crushed stone and sand aggregate per hour was constructed at the site. A combine (Channel Constructors), was formed by four major contractors to operate the plant and excavate an open channel between two power-generating plants for the project. About half of the rock (limestone) taken from the 500-foot wide, mile-long channel was used as raw material for the plant. Output from the plant consisted mainly of aggregate suitable for concrete. A substantial quantity of stone sand and dike filter materials also was produced. Limestone used mainly for concrete aggregate and roadstone also was produced in the county by Niagara Stone Division, Olsker-McLain Industries, Inc. (Niagara Falls); Frontier Stone Products, Inc. (Lockport); and Royalton Stone Corp. (Gasport). Prepared sand was produced at the Lockport plant of Gasport Sand & Gravel Co., Inc.

Oneida.—Limestone for riprap, agstone, and concrete aggregate was quarried and produced at the Prospect No. 6 and Oriskany Falls No. 5 quarries of Eastern Rock Products, Inc. Commercial production of sand and gravel increased to 643,000 tons from 432,000 tons in 1958. Output consisted mainly of prepared material for building, paving, and molding purposes. Crude iron oxide pigment was mined by Clinton Metallic Paint Co. from its Brimfield underground mine near Clinton. The material was used in manufacturing red paints. Longwall mining methods were employed in the mine; and milling consisted of crushing, drying, and grinding.

Onondaga.—The county ranked second in output of limestone. General Crushed Stone Co. (Jamesville) produced limestone mainly for highway construction and maintenance. Most of the limestone produced at the Jamesville quarry of Solvay Process Division, Allied Chemical Corp., was used in manufacturing quicklime for producing alkalies. The company also operated wells at Tully and a Syracuse plant for producing evaporated salt and brine. The brine was used with the lime in manufacturing soda ash. The evaporated salt, produced in vacuum pans, was used mainly for manufacturing chemicals. Alpha Portland Cement Co. produced portland and masonry cements at its Jamesville plant. Limestone (cement rock), shale, sand, gypsum, and iron ore were used as cement raw materials. The entire output of portland and masonry cements was shipped to consumers within the State.

Commercial production of sand and gravel totaled 824,000 tons in 1959, a 34-percent increase over 1958. Output, mainly prepared structural and paving material, came from nine stationary plants. Shale was mined and processed by sintering into lightweight aggregate at the Warners plant of Onondaga Brick Corp. Syracuse Brick Corp. resumed production at its Cicero clay pit and brick plant during the year, after being inactive in 1958. Syracuse Pottery Co., Inc. (Warners) mined red clay for use in manufacturing pottery and flowerpots.

Crude perlite from Colorado and New Mexico was expanded at the Syracuse plant of Minerals Processing Corp. The expanded perlite was used for plaster and concrete aggregate, soil conditioning, and other purposes. The King Laboratories, Syracuse, manufactured a small quantity of strontium metal. The principal use for this product and some of its alloys was as getters in the removal of the last traces of gases in electronic tubes. Quantities needed are limited, and the prices are relatively high.

Ontario.—Limestone used for highway and railroad contruction and maintenance was quarried near Geneva by General Crushed Stone Co. Sand and gravel production was reported from six commercial operations and totaled 256,000 tons. Output was mainly near Geneva, Clifton Springs, Oaks Corners, and Victor.

Orange.—Commercial sand and gravel production was reported from eight principal producers. Output totaled 613,000 tons, an 8-percent increase over 1958. Truck, water, and rail transportation were utilized. Dutchess Quarry & Supply Co. Inc. produced limestone for concrete aggregate and roadstone at Goshen. The county ranked third among the State's 10 clay-producing counties. Miscellaneous clay and shale for manufacturing building bricks was produced at the Newburgh plant of Jova Brick Works. Sterling Forest Peat Co., Inc. (formerly Sterling Forest Peat Humus Co., Inc.), produced reed-sedge peat from a bog near Tuxedo.

Orleans.—Clarendon Stone Co., Inc. (Clarendon), produced limestone for highway construction and maintenance. Commercial production of sand and gravel totaled 44,000 tons and was used mainly for building and paving purposes. Five stationary plants near Albion and Medina were active during the year.

Oswego.—Commercial sand and gravel production in the county consisted of building and paving material from Lacona and Scriba and molding sand from Pulaski. Rail and truck transportation were utilized.

Otsego.—Barrett Division, Allied Chemical Corp., produced limestone for concrete aggregate, riprap, and agstone at its Richfield Springs quarry. Sandstone (bluestone) for construction and architectural uses was quarried near Oneonta by Oneonta Blue Stone Co., Inc. Commercial production of prepared sand and gravel was reported principally from Milford and Unadilla.

Putnam.—Limestone for mineral filler and agstone was produced at the Patterson quarry of Patterson Mineral Corp. Harlem Valley Crusher Co., Inc. (Patterson), produced bank-run road gravel.

Rensselaer.—Fitzgerald Brothers Construction Co. produced crushed and broken stone for concrete aggregate and roadstone at the Campbell Mountain quarry (Brunswick). Commercial output of sand and gravel in the county totaled 205,000 tons of unprepared material, excavated from six locations. Champlain Brick Co. (Mechanicville) resumed production of miscellaneous clay for building brick and artificial abrasives.

Richmond.—Crude gypsum was calcined and processed into finished building products at the New Brighton plant of United States Gypsum Co.

Rockland.—The county was replaced by Niagara County as the leading stone-producing county. New York Trap Rock Corp. produced limestone used exclusively for concrete aggregate at Tompkins Cove. The company also was the major producer of basalt in the State. Basalt output from its Haverstraw and West Nyack quarries was crushed and broken for use as riprap, concrete aggregate, roadstone, and stone sand. Most of the company's output from the Tompkins Cove and Haverstraw quarries was shipped by barge to markets in the metropolitan New York area; the bulk of the West Nyack quarry output was shipped by truck. Basalt for railroad ballast and concrete aggregate was also quarried at Suffern.

Commercial production of sand and gravel increased to 692,000 tons, from 548,000 tons in 1958. Output, mainly building and paving material, was recovered from operations near Hillburn, Mount Ivy, Sparkill, Stony Point, and Thiells. Total county production was shipped to consumers by truck. United States Gypsum Co. (Stony Point) calcined and processed crude gypsum into finished building products.

St. Lawrence.—Jones & Laughlin Steel Corp. mined iron ore (magnetite) at its Benson open-pit mine near Star Lake in southern St. Lawrence County. The pit was mined by multiple bench methods. Ore-treatment steps comprised crushing, screening, grinding, heavy-medium separation, flotation, magnetic concentration, and sintering. Because of greater demand for ore at the Cleveland (Ohio) and Aliquippa (Pa.) blast furnaces, Jones & Laughlin Steel Co. in early January increased production at its Benson mine from 70 to 85 percent of capacity. The mine operation was extended from 15 to 18 shifts a week. The mine was closed in July by a strike.

St. Joseph Lead Co. recovered zinc, lead, and silver from the Balmat and Edwards mines. Mine operation, on a 5-day work basis during the latter part of 1958, was increased to a 6-day work week January 5. This rate continued until July 1 when a strike idled the mines through November 1. After mining resumed on November 2, a 6-day week was continued for the remainder of 1959. Declines in accident frequency and severity rates at both mines were reported during 1959. The ore reserve position at each mine was maintained at a satisfactory level. Random-pillar open stoping was used in both mines. Development at the Balmat mine consisted of 4,577 feet of raising, 6,022 feet of drifting, 21,565 feet of underground diamond drilling, and 57,129 feet of long-hole drilling. Development and exploration at the underground Edwards mine included 1,271 feet of raising, 1,567 feet of drifting, 4,943 feet of underground diamond drilling, and 6,130 feet of long-hole drilling. Treatment at both the 600-ton Edwards and 1,800-ton Balmat mills consisted of crushing, screening, grinding, flotation, and drying. Zinc concentrate from both mines was shipped to the company smelter at Josephtown, Pa. Lead concentrate from Balmat and lead residue from Josephtown were shipped to the St. Joseph Lead Co., Herculaneum (Mo.) smelter for recovery of lead and silver.

Crude talc was mined underground at three mines by two companies and ground at nearby company-owned plants. Exploration at the Wight (Balmat) and No. 3 Edwards (Edwards mines) of International Talc Co. consisted of raising, drifting, crosscutting, and diamond drilling. The underground mining method utilized at both mines was sublevel stoping with pillars. The Gouverneur Talc Co., Inc. mine, near Balmat, was developed entirely by room and pillar and shrinkage stoping. Exploration work consisted of raising, subdrifting, drifting, and crosscutting.

Limestone used mainly for concrete aggregate and roadstone was produced in the county by Barrett Division, Allied Chemical Corp. (Norwood), and by McConville, Inc. (Ogdensburg). Balducci Crushed Stone Co. (Gouverneur) produced crushed marble for agstone and concrete aggregate. Commercial sand and gravel production totaled 172,000 tons in 1959 and was centered near Gouverneur, Potsdam, and Spragueville. Most of the output was prepared material for the construction industry. Specimens of various hexagonites, tremolite, and talc were recovered near Fowler; some sphalerite was recovered near Balmat.

The W. S. Moore Co., Duluth, Minn., which had been exploring magnetic iron-ore bodies near Newton Falls since 1956, reportedly exercised its option on the property. The owners of magnetite-bearing land, the Newton Falls Paper Mill, Inc., would receive royalty payments from any ore mined. The deposits are close to the Jones & Laughlin Steel Corp. mines near Star Lake (Benson mines).[5]

Saratoga.—Commercial sand and gravel output, chiefly molding sand, was recovered by 11 operations mainly near Clifton Park, Jonesville, Gansevoort, and Ushers. Output totaled 186,000 tons, a 49-percent increase over 1958. Fifty-nine percent of the output was shipped by rail; the remainder by truck. Limestone used in manufacturing cement was quarried at Glens Falls and was transported to the Warren County cement plant of Glens Falls Portland Cement Co., Division of the Flintkote Co. Pallette Stone Corp. produced limestone at Saratoga Springs for use mainly as railroad ballast.

Schenectady.—Commercial sand and gravel production totaled 222,000 tons and was from four principal operations—two near Schenectady and one each near Rotterdam and Scotia.

Schoharie.—Portland and masonry cements were produced at the Howes Cave plant of North American Cement Co. Limestone (quarried nearby), shale, gypsum, and iron ore, were used as cement raw materials. Shipments of finished cement were chiefly to consumers in New York and the New England States. Limestone also was produced in the county by Cobleskill Stone Products Division, Allied Materials Corp. (Cobleskill), Schoharie Stone Corp., and Masick Soil Conservation Co., both near Schoharie.

Schuyler.—Evaporated salt was produced near Watkins Glen by International Salt Co., Inc., mostly by the vacuum-pan process. Some of the salt was sold in pressed blocks. Shipments were mainly to consumers in New York and other Northeastern States. Limited quantities were exported to Canada and other foreign countries. Building sand and paving gravel were recovered near Watkins Glen.

Seneca.—Reed-sedge peat was recovered by Finger Lakes Peat Moss & Junius Peat Co., Inc., from bogs near Junius.

Steuben.—Commercial sand and gravel consisting mainly of prepared building and paving material was recovered at four operations.

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[5] Mining World, vol. 21, No. 6, May 1959, p. 75.

Producers were Bath Sand and Gravel Co. (Bath), Rhinehart Sand & Gravel, Inc. (Corning), Dalrymple Gravel & Construction Contracting Co. (Corning), and Buffalo Slag Co., Inc. (Cohocton).

Suffolk.—The county continued as the State's leading sand-and-gravel-producing area. Commercial output increased to 5.9 million tons from 5.1 million tons in 1958. Eighty-eight percent of the commercial output was washed, screened, or otherwise prepared, compared with 81 percent in 1958. Two of the county's 17 active producers reported production of over 1 million tons of sand and gravel. Most of the material was shipped to consumers by barges; truck and rail transportation also were used.

Sullivan.—Sand and gravel was recovered mainly by three producers: I. Pshonick & Son, Corp. (Liberty), Sullivan Highway Products Co. (Masten Lake), and Valley Sand & Gravel Co. (Mongaup Valley). Most of the county output (prepared material) was shipped to consumers by truck. Sandstone (bluestone) was quarried at unspecified locations and shipped to Delaware County for fabrication as architectural stone and flagging.

Tioga.—County sand and gravel production, consisting mainly of prepared material, was recovered principally from plants near Owega and Barton.

Tompkins.—Rock salt was recovered from an underground mine near Myers by Cayuga Rock Salt Co., Inc., by a modified room-and-pillar method. The bulk of the output was used for ice removal on highways and for manufacturing chemicals, mainly within the State. International Salt Co., Inc., used vacuum pans for recovering evaporated salt at its Ludlowville refinery. The evaporated salt was sold to a wide variety of consuming industries, mainly in New York. Prepared building and paving sand and gravel was produced by Rumsey-Ithaca Corp. and University Sand & Gravel, both near Ithaca. Finger Lakes Stone Co., Inc., quarried dimension sandstone (mainly sawed architectural) at its University quarry near Ithaca.

Ulster.—The value of mineral production more than doubled in 1959 as the Kingston plant of Hudson Cement Co., Division Colonial Sand and Stone Co., Inc., operated for its first full year. Limestone (mined nearby), gypsum, mill scale, and pyrite cinders were used as cement raw materials. The finished portland cement was shipped to consumers (ready-mixed concrete) in New York and New Jersey. Capacity at the plant was doubled during the year. Natural and masonry cements were produced at the Rosendale plant of Century Cement Mfg. Co., Inc., from stone quarried nearby. The masonry cement was shipped to consumers in New York, New Jersey, Pennsylvania, Connecticut, and Rhode Island. Callanan Road Improvement Co. quarried and crushed limestone chiefly for concrete aggregate and roadstone at plant No. 3 (Esopus). The crushed stone was shipped mainly by barge.

The county ranked second among the State's clay-producing areas. Hammond Saginaw Corp. and The Hutton Co., both near Kingston, mined miscellaneous clay for manufacturing building brick. Sand and gravel output came from two principal operations. Prepared building and paving material was produced by Hurley Sand & Gravel Co., Inc. (Hurley) and Dutchess Quarry & Supply Co., Inc. (Wawarsing).

Warren.—Portland and masonry cements were produced at the Glens Falls plant of Glens Falls Portland Cement Co., Division of the Flintkote Co., mainly from limestone (cement rock) quarried in Saratoga County. Gypsum, sand, iron ore, and slag were also used as cement raw materials. New York and New England were the main markets for the finished cements. Barton Mines Corp. mined and processed abrasive garnet at North Creek. The refined garnet was used in manufacturing sandpaper and for grinding and polishing glass. Jointa Lime Co., Inc., quarried and crushed limestone used exclusively for concrete aggregate and roadstone near Glens Falls. The county led in gem and mineral-specimen valuation of crude and finished garnet recovered near North Creek.

Washington.—Slate production in the county was centered near Granville, Hampton, Middle Granville, and Whitehall. Dimension-slate output was mainly roofing and flagging material. Ground slate was used mainly for manufacturing natural and artificially colored roofing granules. Bank-run gravel was recovered principally from pits near Argyle, Clemons, and Fort Ann.

Wayne.—General Crushed Stone Co. quarried limestone near Sodus for use as agstone and for highway construction and maintenance. Commercial sand and gravel was produced in the county by M. A. Montemorano & Sons (Clyde) and Abram Cleason Co., Inc. (Palmyra). Output was used primarily in construction work.

Westchester.—Dimension granite, mainly for construction work, was produced by Lake Street Granite Quarry Corp. (White Plains) and by DiRienzo Brothers and Baratta & D'Amato (both near Yonkers). Universal Marble Products Corp. (Thornwood) quarried and crushed white dolomitic marble for a wide variety of uses. The main uses were terrazzo, cast stone, stucco, and agricultural lime. Emery for abrasive purposes was mined from open pits by DiRubbo & Ellis at the Kingston mine, and by DeLuca Emery mine near Croton and Peekskill.

Sand and gravel was produced by Camarco Materials & Supply Co. (Somers) and Peekskill Masons Supply Co., Inc. (Peekskill). Most of the county output was washed, screened, or otherwise prepared and shipped to consumers by truck. Stone Age Humus Corp. produced humus peat near Armonk. The Sonotone Corp., Elmsford, N.Y., was one of three firms in the United States reporting production of cadmium-nickel batteries. Batteries were made in various sizes for use in civil and military aircraft, guided missiles, and refrigerator railway cars.

Wyoming.—Evaporated salt was produced by the open- and vacuum-pan processes at the Silver Springs plant of Morton Salt Co. American Bluestone Co. produced sawed and dressed architectural sandstone (bluestone) at the Ambluco quarry (Portageville). The stone was used in constructing interiors of public schools in New York City and a State Hospital at Gowanda, N.Y. Limited quantities of commercial sand and gravel were produced at unspecified locations in the county.

Yates.—Paving sand and gravel was produced by the road maintenance crews in the town of Jerusalem.

The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of North Carolina.

By James L. Vallely,[1] Jasper L. Stuckey,[2] and Mildred E. Rivers[3]

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NONMETALS and copper, iron ore, tungsten, and byproduct gold and silver comprised the mineral production of North Carolina in 1959. In order of value, stone, sand and gravel, mica, feldspar, copper, and clays were the principal minerals mined. North Carolina led all States in producing feldspar, sheet and scrap mica, olivine and lithium minerals (spodumene). The State was third in output of talc and pyrophyllite combined and was the only State producing millstones.

Production of copper increased substantially. Lithium output was less than half that of 1958, and activity in tungsten was limited to shipments from stock. Production of iron ore was resumed for the first time since 1936. Output of miscellaneous clay, feldspar, sand and gravel, olivine, and stone increased over 1958; talc and pyrophyllite showed little change; and kaolin declined. Both sheet and scrap mica production, although lower in quantity, were higher in value than in 1958.

Employment and Injuries.—Although fewer operations were active in 1959, total employment, as represented by the number of man-hours worked, increased 17 percent over 1958. Both the number of men working daily and the average active days were above 1958. Only in the metal-mine category were fewer hours worked than in 1958.

Three fatal accidents occurred in 1959, compared with 5 in 1958, and nonfatal accidents rose from 358 to 441. The injury frequency rate was slightly higher—29 injuries per million man-hours compared with 28 in 1958. Both metal- and nonmetal-mine injury frequency rates were higher (4 and 37 percent, respectively), whereas the rate for quarries and mills declined 11 percent and that for sand and gravel mines 12 percent.

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TABLE 1.—Mineral production in North Carolina [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Abrasive stones	(2)	$2	(3)	$5
Clays [4]	2,047	1,187	2,524	1,522
Gem stones	(2)	1	(2)	9
Gold (recoverable content of ores, etc.)...troy ounces	876	31	965	34
Mica:				
Scrap	51	1,041	48	1,212
Sheet...pounds	521,701	1,722	505,623	1,755
Sand and gravel	7,044	5,880	8,580	7,426
Silver (recoverable content of ores, etc.)...troy ounces	15,157	14	16,319	15
Stone	12,385	19,132	12,859	20,302
Talc and pyrophyllite	126	614	127	647
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles and tubemill liners, 1958, and millstones, 1959), asbestos, beryl (1958), copper, feldspar, iron ore (1959), kaolin, lithium minerals, olivine, and tungsten		10,267		7,862
Total North Carolina		39,891		40,789

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Weight not recorded.

[3] Less than 1,000 tons.

[4] Incomplete total; excludes kaolin.

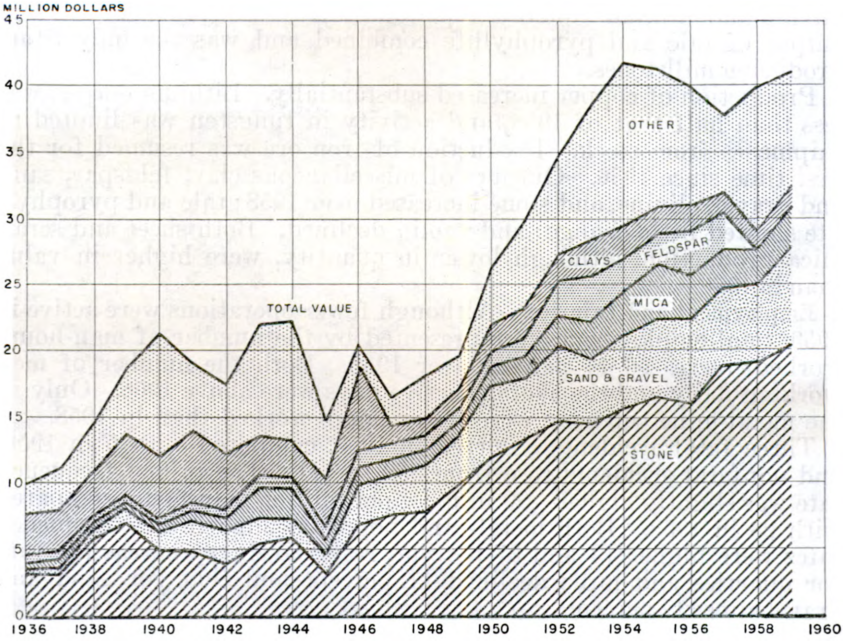

FIGURE 1.—Value of stone, sand and gravel, mica, feldspar, clays, and total value of mineral production in North Carolina, 1936–59.

Trends and Developments.—Consolidations and mergers of crushed-stone producers were a highlight of 1959. Superior Stone Co. acquired Bryan Rock & Sand Co. and became a division of American-Marietta Co. Vulcan Materials Co. purchased the Piedmont Quarry Co., Pioneer Quarry Co., Greystone Granite Quarries, and W. E. Graham & Sons; all were to operate as the W. E. Graham & Sons Division. These acquisitions involved 33 or more pits and quarries.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
	1958						
Nonmetal mines	345	2,892	221	5,108,129	2	93	19
Quarries and mills	70	1,978	241	3,818,960	2	168	44
Metal mines [1]	4	1,258	286	2,881,518		77	27
Sand and gravel mines	110	720	226	1,303,081	1	20	16
Total	529	6,848	239	13,111,688	5	358	28
	1959 [2]						
Nonmetal mines	292	3,695	228	6,742,199	1	174	26
Quarries and mills	74	2,026	275	4,458,547	1	174	39
Metal mines [1]	5	936	350	2,622,497	1	72	28
Sand and gravel mines	121	817	227	1,486,766		21	14
Total	492	7,474	256	15,310,009	3	441	29

[1] Includes aluminum smelters.
[2] Preliminary figures.

Numerous expansions and improvements in the clay industry included: Bennet Brick & Tile, Inc., Kings Mountain plant ($150,000 expansion); Pine Hall Brick & Pipe Co. (new shuttle kiln and drier at Madison); Triangle Brick Co. (new $750,000 plant); and Carolina Solite Corp. (new kiln at Aquadale).

Legislation and Government Programs.—Only one Office of Minerals Exploration (OME) contract for mica was executed and completed during the year; three others for mica and one for copper-zinc, begun in 1958, also were completed in 1959. The Government mica purchasing depot under the General Services Administration (GSA) at Spruce Pine continued to operate. The Atomic Energy Commission (AEC) discontinued purchases of lithium hydroxide upon expiration of its contracts with producers at the end of the year.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grinding pebbles, millstones, and tubemill liners were produced in Rowan County. Tonnage and value of grinding pebbles changed little from 1958; those of tubemill liners were much less; and the value of millstones was considerably higher.

TABLE 3.—OME contracts in force during 1959 [1]

Operator	Mineral	Property	County	Contract	
				Date	Total amount
Appalachian Sulfides, Inc.	Copper-zinc	Ore Knob	Ashe	June 1958	[2] $58,190
B-K Associates	Mica	Welsh & Hall	Macon	October 1959	[2] 33,620
DeGroat, Buchanan, et al	do	Twiggs	Mitchell	May 1958	[3] 5,512
Empire Mica Co.	do	Cloudland	do	June 1958	[3] 6,684
Mitchell Lumber Co.	do	Banner	do	do	[3] 9,864
Ward, Buchanan & Medford	do	Spencer	Stokes	do	[3] 3,260

[1] All contracts completed in 1959.
[2] Government participation, 50 percent.
[3] Government participation, 75 percent.

Asbestos.—Powhatan Mining Co. produced a small tonnage of amphibole asbestos in Transylvania County.

Clays.—Production of clays was higher in both tonnage and value in 1959 than in 1957 and 1958. Output of miscellaneous clay increased 23 percent in tonnage and 28 percent in value; more than offsetting the 20-percent decrease in tonnage and value of kaolin output. Kaolin production came from two pits of Harris Clay Co. in Avery County. Miscellaneous clay was mined from 31 pits in 21 counties for manufacturing brick and other clay products. Principal producers were Pine Hall Brick & Pipe Co., Sanford Brick & Tile Co., Carolina Tufflite Corp., and Southern Lightweight Aggregate Corp.

Feldspar.—Crude-feldspar production, including flotation concentrate, increased 30 percent in tonnage and 16 percent in value over 1958. Mitchell County accounted for most of the tonnage produced, and small quantities came from Avery, Swain, Yancey, and other counties. Output of ground feldspar increased 20 percent in tonnage but only 4 percent in value. International Minerals & Chemical Corp., The Feldspar Corp., and Lawson-United Feldspar & Mining Co. were the principal producers.

TABLE 4.—Sheet mica sold or used by producers, by counties

County	1958		1959	
	Pounds	Value	Pounds	Value
Avery	19,667	$186,176	15,342	$178,171
Buncombe	(1)	(1)	266	562
Catawba			3	76
Cleveland	2,673	18,390	765	8,374
Gaston	7,836	24,680	(1)	(1)
Jackson	462	5,225	309	2,688
Lincoln	383	3,048	(1)	(1)
Macon	7,707	70,332	3,373	44,672
Mitchell	220,242	1,113,319	153,661	1,342,431
Rutherford	2,643	3,170	2,316	2,257
Stokes	15,843	68,048	5,479	77,754
Wilkes	1,123	1,926	(1)	(1)
Yancey	50,237	153,246	13,913	57,551
Undistributed	192,885	74,389	[2] 310,196	[2] 40,778
Total	521,701	1,721,949	505,623	1,755,314

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes Ashe, Burke, Caldwell, Gaston, Haywood Iredell, Lincoln, Transylvania, and Wilkes Counties.

Gem Stones.—Gem stones and gem materials were collected in 17 or more counties in 1959. Among the minerals reported were: Amethyst, beryl, corundum, garnet, kyanite, opal, ruby, sapphire, quartz, and miscellaneous rock specimens.

Lithium.—North Carolina continued as the principal domestic producer of lithium minerals. Production was curtailed greatly as a result of the modification or cancellation of contracts to supply lithium minerals to AEC. Foote Mineral Co. mined and processed spodumene at Kings Mountain, and Lithium Corp. of America processed foreign ore at its Bessemer City plant. In November, Lithium Corp. reopened its North Carolina mine upon cancellation and subsequent settlement of its contract to purchase ore from Quebec Lithium Corp.

Lithium Corp. of America made plans to move its research and development laboratories and manufacturing facilities to Bessemer City, N.C. When expansion is completed the company will process lithium from crude ore to metal and other finished products. Texas Gulf Sulfur Co. took an option on lithium properties of Basic Atomics, Inc., near Lincolnton, N.C., and planned to undertake engineering and economic studies relative to mining and treating the ore by a new process, the patent rights of which are held by Basic Atomics, Inc.

Mica.—Total value of mica production increased 7 percent over 1958. Although output of sheet and scrap mica declined 3 and 6 per-

TABLE 5.—Mica sold or used by producers

Kind	1958		1959	
	Quantity	Value	Quantity	Value
Sheet mica:				
Uncut punch and circle....pounds..	366,643	$30,070	373,271	$35,372
Larger uncut mica....do....	3,834	3,248	1,336	1,468
Full-trim purchased by GSA[1]....do....	151,224	1,688,631	131,016	1,718,474
Total sheet mica....do....	521,701	1,721,949	505,623	1,755,314
Scrap mica: Total....short tons..	50,897	1,041,036	47,736	1,211,721
Grand total (sheet and scrap)....do....	51,157	2,762,985	47,989	2,967,035

[1] Includes full-trimmed mica equivalent of hand-cobbed mica.

TABLE 6.—Ground mica sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Roofing....	18,000	$575,341	$31.96	16,512	$407,186	$24.66
Paint....	5,528	801,392	144.97	6,369	958,952	150.57
Rubber....	2,776	393,683	141.82	3,384	480,328	141.94
Plastics....	778	97,457	125.27	403	54,510	135.26
Wallpaper....	245	33,821	138.04	189	26,406	139.71
Other[1]....	14,013	722,785	51.58	12,338	519,530	42.11
Total....	41,340	2,624,479	63.49	39,195	2,446,912	62.43

[1] Includes pipeline enamel, welding rods, joint cement, well-drilling compounds, textile coatings, and other uses.

cent, respectively, values were up 2 percent for sheet and 16 percent for scrap. Production of sheet and scrap mica was reported from 218 mines in 19 counties, compared with 296 mines in 19 counties in 1958. Considerable tonnage could not be identified as to county and mine of origin. Mitchell County, with 64 mines, accounted for 55 percent of the total value of production; Avery, Cleveland, Macon, Stokes, and Yancey, 42 percent; and 13 or more other counties, the remaining 3 percent. Leading producers of sheet mica were Abernathy Mining Co. (Abernathy mine), Mitchell Lumber Co. (Banner mine), Sink Hole Mining Co. (Sink Hole mine), and Joe L. Snyder (various mines). Principal scrap producers were: Feldspar Corp., Deneen Mica Co., Harris Clay Co., and Kings Mountain Mica Co. Output of ground mica declined 5 percent in tonnage and 7 percent in value from 1958; 10 mica grinders were active during the year.

Four Defense Minerals Exploration Administration (DMEA) mica contracts, carried over from 1958, and one OME contract made in 1959 were completed during the year.

Olivine.—Production of olivine increased 16 percent in tonnage and 10 percent in value over 1958. Mines were operated by Harbison-Walker Refractories Co. in Jackson County and Wiseman Mining Co. in Yancey County.

Perlite.—Carolina Perlite Co., Inc., expanded perlite at Gold Hill from crude material shipped into North Carolina. Tonnage and value of output were considerably higher than in 1958.

Quartz.—Byproduct quartz was recovered from the feldspar flotation plants in Mitchell County. Production data are included under stone.

Sand and Gravel.—Production of sand and gravel ranked second in the State in tonnage and value. Commercial sand and gravel supplied 67 percent of the tonnage and 80 percent of the value, compared with 59 and 72 percent, respectively, in 1958. Paving and structural sand increased 18 percent in tonnage and 21 percent in value. Paving and structural gravel increased 13 percent in tonnage and 32 percent in value. Commercial sand and gravel was produced in 15 counties; gravel only, in 6; and sand only, in 9 others. Forty-two companies operated 46 pits, compared with 27 companies and 32 pits in 1958. Government and contractors produced sand in 65 counties, gravel in 4, and sand and gravel in 6 others. Leading producers were: The State highway department, Becker County Sand & Gravel Co., lessees of B. V. Hedrick, and Bonsal Sand & Gravel Co.

Stone.—Output of stone, the principal mineral product of the State, increased 4 percent in tonnage and 6 percent in value over 1958. Crushed-stone production increased 4 percent in both tonnage and value.

Stone was quarried in 39 counties, as follows: Granite in 24, limestone in 6, marble in 1 (Cherokee), quartz in 1 (Mitchell), slate in 2 (Davidson and Montgomery), and traprock in 8. Commercial stone, excluding quartz, was produced by 22 operators from 54 quarries—39 granite, 7 limestone, 2 slate, 5 traprock, and 1 marble. The State highway commission crushed stone from 10 granite, 1 limestone, and 5 traprock quarries. Leading crushed-stone producers were Superior Stone, a division of American-Marietta Co.; W. E. Graham & Sons, a

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Alamance	----------	----------	2,500	$1,250
Alexander	52,300	$17,830	43,000	13,975
Anson	(1)	(1)	2,037,752	2,337,741
Ashe	9,500	9,500	11,000	5,500
Avery	4,880	4,880	41,066	31,178
Beaufort	78,633	38,100	(1)	(1)
Bertie	22,000	13,200	6,000	3,000
Bladen	106,000	63,600	108,000	56,000
Brunswick	18,000	18,000	18,000	18,000
Buncombe	(1)	(1)	566,824	669,631
Burke	197,223	92,378	202,933	109,088
Cabarrus	----------	----------	118,000	43,683
Caldwell	19,638	19,638	16,921	12,829
Camden	6,000	1,500	3,500	1,050
Carteret	3,000	1,050	3,500	1,575
Caswell	20,000	8,000	38,000	19,000
Catawba	69,935	24,372	57,537	19,376
Chowan	----------	----------	1,800	950
Clay	24,400	24,400	----------	----------
Cleveland	38,500	15,400	43,771	17,508
Columbus	79,000	47,400	80,600	42,350
Craven	(1)	(1)	(1)	(1)
Cumberland	(1)	(1)	(1)	(1)
Currituck	7,000	1,750	30,100	9,030
Dare	3,000	750	7,000	2,100
Davidson	184,000	92,000	190,650	95,325
Davie	79,000	39,500	83,000	49,800
Duplin	8,000	8,000	(1)	(1)
Edgecombe	----------	----------	2,500	1,325
Forsyth	121,000	60,500	(1)	(1)
Franklin	6,000	3,000	4,000	2,000
Gaston	36,717	14,686	36,823	14,729
Gates	6,000	1,500	7,500	2,250
Graham	23,200	23,200	----------	----------
Granville	4,835	3.142	7,110	5,332
Greene	54,800	15,897	60,000	27,000
Guilford	3,925	1,962	3,450	3,450
Halifax	4,030	2,400	5,600	3,000
Harnett	(1)	(1)	(1)	(1)
Haywood	(1)	(1)	213,291	263,839
Henderson	25,800	28,200	----------	----------
Hertford	17,000	4,250	13,500	4,225
Hoke	(1)	(1)	83,401	103,697
Hyde	1,600	400	1,400	740
Iredell	81,328	27,506	(1)	(1)
Jackson	43,800	48,500	----------	----------
Johnston	35,000	35,000	33,500	33,500
Jones	40,556	21,822	41,886	20,979
Lee	----------	----------	75,180	40,000
Lenoir	200,953	154,330	169,754	133,851
Lincoln	32,000	12,800	37,037	14,814
Macon	(1)	(1)	(1)	(1)
Martin	30,000	7,500	17,000	5,370
McDowell	(1)	(1)	(1)	(1)
Mecklenberg	----------	----------	12,000	9,000
Mitchell	----------	----------	25,386	19,410
Montgomery	10,000	6,000	77,200	27,020
Moore	307,015	147,197	416,146	216,647
Nash	41,136	24,700	(1)	(1)
New Hanover	(1)	(1)	11,600	11,600
Northampton	(1)	(1)	(1)	(1)
Onslow	5,000	5,000	5,000	5,000
Pamlico	3,000	1,050	8,000	3,600
Pasquotank	19,000	4,750	3,000	900
Pender	4,000	4,000	4,000	4,000
Perquimans	2,000	500	10,000	3,000
Person	8,550	5,557	12,900	9,675
Pitt	(1)	(1)	(1)	(1)
Polk	61,800	47,300	----------	----------
Randolph	5,000	1,250	----------	----------
Richmond	13,875	17,500	9,650	4,825
Robeson	(1)	(1)	(1)	(1)
Rockingham	----------	----------	3,185	3,185

See footnote at end of table.

TABLE 7.—Sand and gravel sold or used by producers, by counties—Continued

County	1958		1959	
	Short tons	Value	Short tons	Value
Rowan	38,000	$19,000	41,250	$20,625
Rutherford	150,000	75,000	175,967	149,572
Sampson	9,000	9,000	9,000	9,000
Stanly	-------	-------	4,000	1,400
Stokes	99,000	49,500	95,000	57,000
Surry	17,945	10,800	10,960	21,266
Transylvania	10,034	13,390	(1)	(1)
Tyrrell	1,600	400	-------	-------
Vance	4,000	2,000	2,000	1,000
Wake	2,200	1,320	5,068	3,040
Washington	70,000	17,500	48,000	25,440
Watauga	82,738	62,674	11,475	6,997
Wayne	(1)	(1)	(1)	(1)
Wilkes	22,485	13,500	33,425	17,700
Wilson	25,765	15,500	77,625	64,841
Yadkin	33,515	20,000	16,175	8,570
Yancey	(1)	(1)	33,500	27,805
Undistributed	4,198,641	4,297,712	2,893,977	2,453,955
Total	7,043,852	5,879,943	8,579,875	7,426,113

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Paving	2,562,045	$1,360,400	$0.53	3,260,641	$1,804,447	$0.55
Structural	1,653,773	1,199,291	.73	1,726,292	1,284,202	.74
Railroad ballast	77,546	37,016	.47	(1)	(1)	(1)
Fill	-------	-------	-------	39,474	23,514	.60
Filter	1,600	3,200	2.00	(1)	(1)	(1)
Other	89,450	58,248	.65	7,600	7,600	1.00
Total	4,384,414	2,658,155	.61	(1)	(1)	(1)
Gravel:						
Paving	1,450,627	1,449,971	1.00	1,948,823	2,247,899	1.15
Structural	1,078,351	1,546,824	1.43	1,329,248	1,698,848	1.28
Railroad ballast	19,417	15,230	.78	26,325	19,338	.73
Other	111,043	209,763	1.89	(1)	(1)	(1)
Total	2,659,438	3,221,788	1.21	(1)	(1)	(1)
Total sand and gravel	7,043,852	5,879,943	.83	8,579,875	7,426,113	.86

[1] Figures withheld to avoid disclosing individual company confidential data; included with "Total sand and gravel."

division of Vulcan Materials Co., and Nello L. Teer Co. Columbia Marble Co., Harris Granite Quarries, and North Carolina Granite Co. were the principal producers of dimension stone. Superior Stone Co. and Bryan Rock & Sand Co. were acquired by American-Marietta Co. and operated as the Superior Stone Division of American-Marietta. Vulcan Materials Co. purchased the quarries of W. E. Graham & Sons, Greystone Granite Quarries, Piedmont Quarry Co., and Pioneer

Quarry Co. These companies will operate as the W. E. Graham & Sons, Division of Vulcan Materials Co.

Talc and Pyrophyllite.—Production of crude talc and pyrophyllite increased only 1 percent in tonnage, but talc increased 2 percent in value and pyrophyllite 7 percent. However, sales of products gained 14 percent in tonnage and 8 percent in value over 1958. Ground talc increased 2 percent in tonnage and 1 percent in value, and ground pyrophyllite increased 5 and 7 percent, respectively, in tonnage and value. Sawed talc (crayons) and crude pyrophyllite increased substantially over 1958. Ground talc was sold principally for textile use and toilet preparations. Ground pyrophyllite was used

TABLE 9.—Crushed granite sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Alamance	55,068	$79,302	(1)	(1)
Alleghany	------	------	50,000	$62,000
Buncombe	45,191	68,296	19,732	29,590
Cabarrus	40,000	20,000	60,000	60,000
Caswell	(1)	(1)	408,435	627,948
Catawba	(1)	(1)	(1)	(1)
Cherokee	24,720	57,000	15,000	37,500
Forsyth	(1)	(1)	(1)	(1)
Gaston	(1)	(1)	(1)	(1)
Graham	11,000	22,000	------	------
Guilford	1,747,847	2,767,399	(1)	(1)
Henderson	(1)	(1)	------	------
Jackson	16,100	32,200	------	------
Macon	9,400	18,800	------	------
Mecklenburg	(1)	(1)	(1)	(1)
Nash	(1)	(1)	------	------
New Hanover	------	------	(1)	(1)
Orange	18,938	28,407	11,873	17,809
Polk	5,000	10,000	------	------
Randolph	136,850	206,987	168,595	252,892
Rockingham	53,166	26,582	(1)	(1)
Rowan	(1)	(1)	(1)	(1)
Surry	(1)	(1)	(1)	(1)
Swain	5,200	10,400	------	------
Transylvania	19,000	38,000	135,000	189,000
Vance	(1)	(1)	(1)	(1)
Wake	(1)	(1)	(1)	(1)
Wilkes	------	------	(1)	(1)
Wilson	(1)	(1)	(1)	(1)
Yadkin	(1)	(1)	(1)	(1)
Other counties	5,996,801	8,554,030	7,591,862	10,634,815
Total	8,184,281	11,939,403	8,460,497	11,911,554

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 10.—Talc and pyrophyllite production

Year	Crude mined		Sales (crude, sawed, and ground)	
	Short tons	Value	Short tons	Value
1950–54 (average)	116,006	(1)	114,065	$1,858,083
1955	125,206	$571,689	120,885	1,999,560
1956	125,487	529,205	121,782	1,921,834
1957	120,905	557,850	98,185	2,003,189
1958	126,158	613,779	110,528	2,078,176
1959	127,296	647,348	125,777	2,251,205

[1] Data not available.

principally in ceramics and insecticides, whereas the crude pyrophyllite was used for ceramics and refractories. Talc was mined in Cherokee County and pyrophyllite in Alamance, Montgomery, Moore, Orange, and Randolph Counties.

Vermiculite.—Zonolite Co. exfoliated vermiculite at its High Point plant from crude shipped into the State.

METALS

Beryllium.—No beryl production was reported in 1959 except small quantities for mineral specimens.

Gold, Silver, Copper, Lead, and Zinc.—Copper production increased 14 percent in tonnage and 33 percent in value over 1958. The Ore Knob mine of Appalachian Sulfides, Inc., was the only producer. The quantity of gold and silver recovered from copper ores was virtually unchanged from 1958. A DMEA contract executed in 1958 by Appalachian Sulfide, Inc., was completed in 1959. Development and exploration during the year included: Diamond drilling, surface 6,828 feet, underground, 15,786 feet; drifting and crosscutting, 4,268 feet; raising, 3,277 feet; and other excavation, 119,925 cubic feet. In the last half of 1959 Ore Knob's milling rate averaged 800 tons per day, compared with 420 tons per day in 1958. Tennessee Copper Co. did diamond drilling and other exploratory work at the Silver Hill mine in Davidson County.

Iron Ore.—Cranberry Magnetite Corp. reopened the old Cranberry mine in Avery County and produced a small tonnage of ore.

Tungsten.—Tungsten Mining Corp. continued to ship tungsten concentrate from stocks. The Hamme mine was inactive the entire year.

Minor Metals.—High-purity silicon was produced by E. I. du Pont de Nemours & Co., Inc., in a plant completed in 1958 at Brevard.

TABLE 11.—Mine production of recoverable copper, 1901–59

Year	Short tons	Value	Year	Short tons	Value
1901	122	$36,600	1927	2,722	$713,048
1902	173	61,600	1928	4,104	1,181,808
1903	55	22,200	1929	4,402	1,549,407
1904	115	46,000	1930	6,695	1,740,692
1905	240	80,000	1931	4,398	799,508
1906	352	135,829	1932	1,771	223,134
1907	291	116,416	1933	1,933	247,385
1908	10	2,560	1934	1,850	296,000
1909	112	29,186	1935	1,606	266,629
1910	70	17,845	1936	1,329	244,554
1911	-----	-----	1937	1,475	357,011
1912	38	12,526	1938	1,226	240,208
1913	-----	-----	1939	951	197,704
1914	10	2,718	1940	1,290	291,540
1915	9	3,005	1941	1,251	295,236
1916	5	2,411	1942	1,122	271,524
1917	62	34,123	1943	1,112	288,990
1918	-----	-----	1944	282	76,140
1919	2	620	1945–54	-----	-----
1920–22	-----	-----	1955–59	(1)	(1)
1923	31	9,112			
1924–25	-----	-----	Total[2]	41,950	10,098,887
1926	734	205,618			

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[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Excludes 1955–59.

REVIEW BY COUNTIES

Ninety-five of the 100 counties in North Carolina reported mineral production; Mitchell, Cleveland, Guilford, Ashe, and Anson were the leaders. In addition to the detailed county production listed in Table 12, considerable crude feldspar and sheet and scrap mica, also a small quantity of gem stones, were produced—all of undetermined county origin.

Alamance.—Superior Stone Co., a division of American-Marietta Co. (Burlington and Mebane quarries) and North Carolina State Highway & Public Works Commission crushed granite for concrete and roads. Boren & Harvey (Snow Camp mine) mined pyrophyllite for refractory and ceramic uses. Hanford Brick Co., Inc., mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Alexander.—The State highway commission mined 43,000 tons of paving sand. Ruth P. Stanley and Fred Allen collected a small quantity of gem stones (emerald, sapphire, quartz crystals, and hiddenite).

Alleghany.—Ararat Products Co. crushed 50,000 tons of granite for concrete and roads. Ruth P. Stanley collected a few gem stones (manganite and quartz crystals).

TABLE 12.—Value of mineral production in North Carolina, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Alamance	(2)	(2)	Granite, talc, miscellaneous clay, sand and gravel.
Alexander	$17,830	$14,360	Sand and gravel, gem stones.
Alleghany	----------	62,030	Granite, gem stones.
Anson	(2)	2,382,641	Sand and gravel, traprock.
Ashe	(2)	(2)	Copper, gold, silver, mica, sand and gravel.
Avery	(2)	(2)	Mica, kaolin, sand and gravel, feldspar, iron ore, gem stones.
Beaufort	38,100	(2)	Sand and gravel.
Bertie	13,200	3,000	Do.
Bladen	63,600	56,000	Do.
Brunswick	18,000	18,000	Do.
Buncombe	(2)	(2)	Sand and gravel, granite, mica, gem stones.
Burke	(2)	(2)	Sand and gravel, mica.
Cabarrus	20,000	103,683	Granite, sand and gravel.
Caldwell	(2)	(2)	Sand and gravel, mica.
Camden	1,500	1,050	Sand and gravel.
Carteret	1,050	1.575	Do.
Caswell	(2)	646,948	Granite, sand and gravel.
Catawba	(2)	(2)	Granite, miscellaneous clay, sand and gravel, mica.
Chatham	268,420	388,173	Miscellaneous clay, traprock.
Cherokee	(2)	(2)	Talc, marble, granite.
Chowan	----------	950	Sand and gravel.
Clay	24,500	70	Gem stones.
Cleveland	(2)	(2)	Lithium minerals, limestone, mica, sand and gravel, miscellaneous clay.
Columbus	47,400	42,350	Sand and gravel.
Craven	(2)	(2)	Limestone, sand and gravel.
Cumberland	214,295	(2)	Sand and gravel, miscellaneous clay.
Currituck	1,750	9,030	Sand and gravel.
Dare	750	2,100	Do.
Davidson	(2)	(2)	Sand and gravel, slate, miscellaneous clay.
Davie	39,500	49,800	Sand and gravel.
Duplin	(2)	(2)	Do.
Durham	(2)	(2)	Traprock, miscellaneous clay.
Edgecombe	----------	1,325	Sand and gravel.
Forsyth	(2)	(2)	Granite, sand and gravel.
Franklin	3,000	2,000	Sand and gravel.
Gaston	57,223	(2)	Granite, sand and gravel, miscellaneous clay, mica.
Gates	1,500	2,250	Sand and gravel.
Graham	45,000	----------	
Granville	3,142	5.332	Do.

See footnotes at end of table.

TABLE 12.—Value of mineral production in North Carolina, by counties[1]—Con.

County	1958	1959	Minerals produced in 1959 in order of value
Greene	$15,897	$27,000	Sand and gravel.
Guilford	2,814,261	(2)	Granite, miscellaneous clay, sand and gravel.
Halifax	26,600	(2)	Miscellaneous clay, sand and gravel.
Harnett	(2)	(2)	Sand and gravel, miscellaneous clay.
Haywood	(2)	(2)	Sand and gravel, gem stones, mica.
Henderson	523,812	342,846	Limestone, miscellaneous clay.
Hertford	4,250	4,225	Sand and gravel.
Hoke	(2)	103,697	Do.
Hyde	400	740	Do.
Iredell	27,506	(2)	Sand and gravel, mica, gem stones.
Jackson	(2)	(2)	Olivine, mica.
Johnston	(2)	(2)	Traprock, sand and gravel.
Jones	21,822	20,979	Sand and gravel.
Lee	215,500	(2)	Miscellaneous clay, sand and gravel.
Lenoir	154,330	133,851	Sand and gravel.
Lincoln	15,870	15,521	Sand and gravel, gem stones, mica.
Macon	154,503	(2)	Sand and gravel, mica, gem stones.
Madison	(2)	----------	
Martin	7,500	5,370	Sand and gravel.
McDowell	(2)	(2)	Sand and gravel, limestone.
Mecklenberg	(2)	(2)	Granite, sand and gravel.
Mitchell	(2)	(2)	Feldspar, mica, sandstone, sand and gravel, gem stones.
Montgomery	(2)	(2)	Miscellaneous clay, talc, sand and gravel, slate.
Moore	(2)	(2)	Talc, sand and gravel, miscellaneous clay, gem stones.
Nash	(2)	(2)	Sand and gravel.
New Hanover	(2)	(2)	Granite, sand and gravel.
Northampton	(2)	(2)	Sand and gravel.
Onslow	(2)	(2)	Limestone, sand and gravel.
Orange	(2)	(2)	Talc, granite.
Pamlico	1,050	3,600	Sand and gravel.
Pasquotank	4,750	900	Do.
Pender	4,000	4,000	Do.
Perquimans	500	3,000	Do.
Person	5,557	9,675	Do.
Pitt	(2)	(2)	Do.
Polk	60,100	1,200	Granite.
Randolph	(2)	(2)	Granite, traprock, talc, gem stones.
Richmond	17,500	4,825	Sand and gravel.
Robeson	(2)	(2)	Do.
Rockingham	(2)	(2)	Granite, miscellaneous clay, traprock, sand and gravel.
Rowan	1,403,971	2,079,165	Granite, miscellaneous clay, sand and gravel, abrasive stones.
Rutherford	78,511	152,189	Sand and gravel, mica, gem stones.
Sampson	25,880	26,278	Miscellaneous clay, sand and gravel.
Stanly	173,200	267,235	Miscellaneous clay, traprock, sand and gravel.
Stokes	(2)	(2)	Miscellaneous clay, mica, sand and gravel.
Surry	(2)	(2)	Granite, sand and gravel, gem stones.
Swain	151,325	(2)	Limestone, feldspar.
Transylvania	(2)	(2)	Granite, sand and gravel, mica, asbestos.
Tyrrell	400	----------	
Union	(2)	(2)	Traprock, miscellaneous clay.
Vance	(2)	(2)	Granite, tungsten, sand and gravel.
Wake	(2)	(2)	Granite, sand and gravel, gem stones.
Washington	17,500	25,440	Sand and gravel.
Watauga	62,674	6,997	Do.
Wayne	(2)	(2)	Do.
Wilkes	15,536	(2)	Granite, sand and gravel, mica, gem stones.
Wilson	(2)	(2)	Granite, sand and gravel.
Yadkin	(2)	(2)	Do.
Yancey	570,573	302,339	Mica, sand and gravel, feldspar, olivine, gem stones.
Undistributed[3]	32,435,762	33,455,261	
Total	39,891,000	40,789,000	

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[1] Scotland and Warren counties are not listed because no production was reported.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Includes value of feldspar, mica, and gem stones that cannot be assigned to specific counties and values indicated by footnote 2.

Anson.—Anson County ranked fifth in value of mineral production. Lessees of B. V. Hedrick (Lilesville mine), W. R. Bonsal Co. (Bonsal mine), and the State highway commission mined 2,038,000 tons of structural, paving, railroad ballast, and fill sand and gravel. The State highway commission crushed 34,000 tons of traprock for concrete and roads.

Ashe.—Ashe County ranked fourth in value of mineral production. Appalachian Sulphides, Inc. (Ore Knob mine) recovered copper, gold, and silver. Six mica mines were operated. The leading producers were Aldridge & Jesse Callahan (Tucker mine), Joe Snyder (Duncan mine), and Alma Crowder (Walter Houlk mine). The State highway commission mined 11,000 tons of paving gravel.

Avery.—Mica was produced at 32 mines. The leading producers of sheet mica were Joe L. Snyder (Charlie Ridge mine), Benwood Mining Co. (Mill Race mine), and Avery Mining Co. (Avery mine). The leading producer of scrap mica was Harris Clay Co. (Kaolin mine). Harris Clay Co. (Gusher Knob and Kaolin mines) mined kaolin for whiteware, floor and wall tile, refractories, plastics, and artificial abrasives.

The State highway commission mined 41,100 tons of paving gravel. The Feldspar Corp. (Guy, Vance, and Hicks mines) and Charlie Silver (Silver mine) produced crude feldspar. Ruth P. Stanley collected a few gem stones (garnets).

Cranberry Magnetite Corp. reopened the old Cranberry mine which had been idle since 1929, constructed a new mill, and shipped a small quantity of magnetite to Birmingham, Ala.

Beaufort.—J. D. McCotter, Inc., and the State highway commission mined structural and paving sand.

Bertie.—The State highway commission produced 6,000 tons of paving sand.

Bladen.—The State highway commission mined 108,000 tons of paving sand.

Brunswick.—The State highway commission produced 18,000 tons of paving sand.

Buncombe.—Four operators mined structural, paving, and railroad-ballast sand and gravel. The leading producer was Grove Stone & Sand Branch of B. V. Hedrick Gravel & Sand Co. The State highway commission (Weaverville quarry) crushed 20,000 tons of granite for concrete and roads. Three mica mines were operated in 1959. The leading producer was Ben F. and Oliver Reese (Indian Pot mine). G. L. Winslow and Herby Bolick collected a small quantity of gem stones (feldspar and kyanite.)

Burke.—A. P. Causby Sand & Stone Co. and the State highway commission mined paving sand and gravel. Stokes Buchanan (Stillwell mine) and H. Lee Medford (Noah Young mine) mined sheet mica. Great Lakes Carbon Corp. manufactured graphite at its plant in Morganton.

Cabarrus.—Lee White Gravel Pit and the State highway commission mined paving sand and gravel. The State highway commission crushed 60,000 tons of granite for concrete and roads.

Caldwell.—Miller Brothers Co. and the State highway commission mined paving sand and gravel. Conrad Pearch mined a small quantity of sheet mica.

Camden.—The State highway commission produced 3,500 tons of paving sand.

Carteret.—The State highway commission mined 3,500 tons of paving sand.

Caswell.—W. E. Graham & Sons, a division of Vulcan Materials Co. (Danville quarry) and the State highway commission (Ivy Bluff quarry) crushed 408,000 tons of granite for concrete and roads. The State highway commission mined 38,000 tons of paving sand.

Catawba.—Superior Stone Co. Division (Hickory quarry) crushed granite for concrete and roads. Statesville Brick Co. mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand. Joe Lynn (Whitner mine) produced a small quantity of sheet mica.

Chatham.—Four mines produced miscellaneous clay for heavy clay products. The leading producers were Pomona Terra Cotta Co. and Boren Clay Products Co. (Gulf mine). The State highway commission (Goldston quarry) crushed 105,000 tons of traprock for concrete and roads.

Cherokee.—Columbia Marble Co. (Pleasant Valley quarry) quarried dimension marble for rough, sawed, and cut interior stone and crushed marble for terrazzo and other uses. Hitchcock Corp. (Nancy Jordan mine) and Minerals & Metals Corp. (Mulberry Gap mine) mined talc for crayons, textiles, toilet preparations, and other uses. The State highway commission (Dockery and Carringer quarries) crushed granite for concrete and roads.

Chowan.—The State highway commission mined 1,800 tons of paving sand.

Clay.—Fred O. Scruggs collected a few gem stones (ruby corundum in matrix).

Cleveland.—Cleveland County ranked second in value of mineral production. Superior Stone Co. Division (Kings Mountain quarry) crushed limestone for concrete and roads. Seventeen mica mines were operated in 1959. The leading producer of sheet mica was Joe L. Snyder (Campbell, Holiman, Hartman, Ledford, Workman, and Bailey mines). Kings Mountain Mica Co. (Moss and Patterson mines) and Foote Mineral Co. (Kings Mountain mine) were the leading producers of scrap mica.

The State highway commission mined 44,000 tons of paving sand. Bennett Brick & Tile Co. mined 21,000 tons of miscellaneous clay for heavy clay products. Foote Mineral Co. mined and processed lithium minerals at Kings Mountain.

Columbus.—The State highway commission mined 80,600 tons of paving sand.

Craven.—Superior Stone Co. Division (New Bern quarry) and Nello L. Teer Co. (Shell quarry) crushed limestone for concrete and roads. Southern Sand Co., Inc., and the State highway commission mined structural and paving sand.

Cumberland.—Becker County Sand & Gravel Co. and the State highway commission mined structural, paving, and railroad-ballast sand and gravel. Ideal Brick Co. (Linden mine) mined miscellaneous clay for heavy clay products.

Currituck.—The State highway commission produced 30,000 tons of paving sand.

Dare.—The State highway commission mined 7,000 tons of paving sand.

Davidson.—Jacob's Creek Flagstone Co., Inc., and Denton Flagstone Quarry quarried dimension slate for structural millstock and flagging. The State highway commission mined 191,000 tons of paving sand and gravel. Cunningham Brick Co. (Thomasville mine) mined miscellaneous clay for heavy clay products.

Davie.—The State highway commission mined 83,000 tons of paving sand.

Duplin.—James W. Kelley and the State highway commission mined structural and paving sand.

Durham.—Nello L. Teer Co. crushed traprock for concrete and roads. Borden Brick & Tile Co. mined miscellaneous clay for heavy clay products.

Edgecombe.—The State highway commission mined 2,500 tons of paving sand.

Forsyth.—W. E. Graham & Sons Division crushed granite for concrete and roads at the North, Piedmont, South Fork, and No. 421 quarries. Ira Pope & Sons, Inc., Paul Miller, and the State highway commission mined structural and paving sand.

Franklin.—The State highway commission mined 4,000 tons of paving sand.

Gaston.—Superior Stone Co. Division (Gaston quarry) crushed granite for concrete and roads. Kendrick Brick & Tile Co. mined miscellaneous clay for heavy clay products. The State highway commission mined 37,000 tons of paving sand. Harry Southard (Ramsey mine) and Millard Townsend (Huskins mine) mined a small quantity of sheet mica.

Gates.—The State highway commission mined 7,500 tons of paving sand.

Granville.—The State highway commission produced 7,100 tons of paving sand.

Greene.—The State highway commission mined 60,000 tons of paving sand.

Guilford.—Guilford County ranked third in value of mineral production. Superior Stone Co. Division (McLeansville, Pomona, Buchanan, and Jamestown quarries) and W. E. Graham & Sons Division (Stokesville quarry) crushed granite for concrete and roads. Boren Clay Products Co. (Pleasant Garden mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand. Zonolite Co. exfoliated vermiculite in its plant at High Point.

Halifax.—Nash Brick Co. (Ita mine) mined miscellaneous clay for heavy clay products. The State highway commission mined paving sand.

Harnett.—Becker County Sand & Gravel Co. (Senter mine), Nello L. Teer Co., and the State highway commission mined sand and gravel for structural, paving and filtration purposes. Norwood Brick Co. (Lillington mine) mined miscellaneous clay for heavy clay products.

Haywood.—Sale & Alexander (Waynesville mine) mined paving sand and gravel. Fred O. Scruggs collected a few gem stones (sapphires). Alta R. Stewart (Big Ridge mine) mined a small quantity of sheet mica.

Henderson.—Fletcher Limestone Co. (Fletcher quarry) and Cogdill Limestone Co., Inc. (Cogdill quarry) crushed 197,000 tons of limestone for concrete, roads, and other uses. Fletcher Brick Co., Inc.

(Fletcher mine) mined 62,000 tons of miscellaneous clay for heavy clay products.

Hertford.—The State highway commission mined 13,500 tons of paving sand.

Hoke.—Cumberland Sand & Gravel Co. (Vass mine) and the State highway commission mined 83,000 tons of structural, paving, and fill sand and gravel.

Hyde.—The State highway commission mined 1,400 tons of paving sand.

Iredell.—Tarheel Construction Co. and the State highway commission mined paving sand and gravel. Joe Lynn (Stewart mine) mined a small quantity of sheet mica. Ruth P. Stanley collected a small quantity of gem stones (rutile).

Jackson.—Harbison-Walker Refractories Co. (Addie mine) mined olivine for refractories. Nine mines produced mica in 1959. The leading producers of sheet mica were F. E. Stillwell (Stillwell mine) and William G. Ashe (Mack Presnell mine).

Johnston.—Nello L. Teer Co. (Princeton quarry) crushed traprock for concrete and roads. The State highway commission mined 33,500 tons of paving sand.

Jones.—Simmons Marl & Lime Co. and the State highway commission mined paving sand and gravel.

Lee.—Sanford Brick & Tile Co. (Colon mine), Borden Brick & Tile Co. (Sanford mine), and Hanford Brick Co. mined miscellaneous clay for heavy clay products. The State highway commission mined 75,000 tons of paving sand.

Lenoir.—Barrus Construction Co. (Kinston mine) and the State highway commission mined 170,000 tons of sand and gravel for structural, paving, railroad-ballast, and fill purposes.

Lincoln.—Roe Woody (Brown mine) and Pat Buchanan (Miller mine) mined sheet mica. Fred Allen collected a small quantity of gem stones (amethysts). The State highway commission mined 37,000 tons of paving sand.

Macon.—Twenty-four mines produced sheet mica. The leading producers were Roy H. Fouts (Almond Cove and Rock Cut mines) and Harris Mining Co. (Harris mine). The leading producers of scrap mica were A & C Mining Co. (Sheppard Knob mine) and Charles E. Cook (Chalk Hill and Iotla mines). Macon Construction Co. and Hayes Block Co. mined structural sand and paving gravel. Fred Allen, Andrew W. Reid, and others collected a few gem stones (smarogdite-ruby and rhodalite garnets).

Martin.—The State highway commission mined 17,000 tons of paving sand.

McDowell.—Becker County Sand & Gravel Co. (Marion mine) mined sand and gravel for structural, paving, and railroad-ballast uses. The State highway commission (Woodlawn quarry) crushed limestone for concrete and roads.

Mecklenburg.—Superior Stone Co. Division (Charlotte and Pineville quarries) and the State highway commission crushed granite for concrete and roads. The State highway commission mined paving sand.

Mitchell.—Mitchell County ranked first in value of mineral production. Thirteen companies mined crude feldspar. The leading producers were International Minerals & Chemical Corp. (Hawkins and Kona mines), The Feldspar Corp. (Poteat, Wiseman, Sullins, Dogwood Flats, and Chestnut Flats mines), and Lawson-United Feldspar & Minerals Co. (Minpro mine). Sixty-four mines produced mica; 54 produced sheet only (full-trimmed and/or hand-cobbed), 3 scrap only, and 7 both sheet and scrap. The leading producers of sheet mica were Sink Hole Miners (Sink Hole mine), Mitchell Lumber Co. (Banner mine), and Abernathy Mining Co. (Abernathy, Abernathy No. 2, and Abernathy No. 3 mines). The leading producers of scrap mica were The Feldspar Corp. (Poteat and Wiseman mines), DeWeld Mica Co. (Sparks mine), and Southern Mica Co. of North Carolina, Inc. (Sullins mine).

International Minerals & Chemical Corp. and The Feldspar Corp. recovered crushed sandstone (quartz) from feldspar milling. J. J. Rogers, Jr., mined 25,000 tons of paving gravel. Herby Bolick, P. W. Holston, Ruth P. Stanley, Albert V. Topper, and Harley Hines collected various types of gem stones.

Montgomery.—Mt. Gilead Brick Co. mined miscellaneous clay for heavy clay products. T & H Clay Co., Inc., mined pyrophyllite for ceramics. The State highway commission (Candor mine) mined paving sand. Jacob's Creek Flagstone Co. (Edenboro quarry) quarried dimension slate for structural millstock and flagging.

Moore.—Standard Mineral Co., Inc., and Carolina Pyrophyllite Co., Inc., mined pyrophyllite for ceramics, insecticides, refractories, paint, roofing, rubber, and plaster. Five mines produced structural, paving, and fill sand. The leading producer was Pleasants Sand & Supply Co. T & H Clay Co. (Hancock mine) mined miscellaneous clay for heavy clay products. Harley Hines collected a small quantity of gem stones.

Nash.—O. H. Woolard and the State highway commission mined paving sand.

New Hanover.—E. B. Towles Construction Co. crushed stone for concrete and roads. Robbins Sand Pit and the State Highway commission mined sand for fertilizer filler and paving.

Northampton.—Superior Stone Co. Division (Garysburg mine) and the State highway commission mined sand and gravel for structural and paving uses.

Onslow.—Superior Stone Co. Division (Belgrade quarry) crushed limestone for concrete and roads. The State highway commission mined 5,000 tons of paving sand.

Orange.—Boren & Harvey (Hillsboro mine) mined pyrophyllite for refractories. Duke University quarried dimension stone for rough construction use. The State highway commission (Bacon quarry) crushed granite for concrete and roads.

Pamlico.—The State highway commission mined 8,000 tons of paving sand.

Pasquotank.—The State highway commission produced 3,000 tons of paving sand.

Pender.—The State highway commission mined 4,000 tons of paving sand.

Perquimans.—The State highway commission produced 10,000 tons of paving sand.

Person.—The State highway commission mined 13,000 tons of paving sand.

Pitt.—White Concrete Co. (Munford mine) and the State highway commission mined structural, paving, and fill sands.

Polk.—J. C. Williams (Williams quarry) quarried 240 tons of dimension granite for rough construction.

Randolph.—The State highway commission (Parks Cross Road and Glenola quarries) crushed 169,000 tons of granite for concrete and roads. Superior Stone Co. Division crushed traprock for concrete and roads. Carolina Pyrophyllite Co., Inc. (Gerhardt mine) mined pyrophyllite for ceramic and insecticide uses. Herby Bolick and Harley Hines collected a small quantity of gem stones.

Richmond.—The State highway commission (McLeod mine) mined 9,700 tons of paving gravel.

Robeson.—Southern Sand & Gravel Co. (Lumberton mine) and the State highway commission mined paving and fill sand and gravel.

Rockingham.—Superior Stone Co. Division (Reidsville quarry) crushed granite for concrete and roads. Roanoke-Webster Brick Co., Inc. (Draper mine), mined miscellaneous clay for heavy clay products. Garland W. & Morris Hall (Kings quarry) crushed traprock for concrete and roads. The State highway commission mined paving sand.

Rowan.—Six quarries produced dimension granite for use as rubble, rough and dressed construction stone, dressed architectural stone, rough and dressed monumental stone, and curbing and flagging. The leading producer was Harris Granite Quarries Co. (Collins quarry). Superior Stone Co. Division (Woodleaf quarry) crushed granite for concrete and roads. Carolina Tufflite Co. and Isenhour Brick & Tile Co. (East Spencer mine) mined miscellaneous clay for lightweight aggregate and heavy clay products.

Gardner Granite Works produced millstones. Harris Granite Quarries Co. (Balfour quarry) produced tube-mill liners and grinding pebbles. The State highway commission mined 41,000 tons of paving sand. Carolina Perlite Co., Inc., expanded perlite at its mill in Gold Hill.

Rutherford.—A. R. Thompson, contractor, mined paving gravel. Six mines produced full-trimmed mica and one sold a small tonnage of scrap mica. The leading mica producer was Mace & Son. R. D. Groves collected a small quantity of gem stones (corundum and fuchsite).

Sampson.—Crumpler Brick Co., Inc., Sampson Brick Co., Inc., and Patterson Brick Co. mined miscellaneous clay for heavy clay products. The State highway commission mined 9,000 tons of paving sand.

Stanly.—Southern Lightweight Aggregate Corp. (Aquadale mine), Stanly Shale Products, Inc. (Norwood mine), and Yadkin Brick Yards, Inc., mined miscellaneous clay for heavy clay products and lightweight aggregates. The State highway commission crushed 55,000 tons of traprock for concrete and roads at the McManus quarry and mined 4,000 tons of paving sand. Carolina Aluminum Co. produced aluminum metal at Badin.

Stokes.—Pine Hall Brick & Pipe Co. (No. 1 mine) mined miscellaneous clay for heavy clay products. The State highway commission mined 95,000 tons of paving sand. Six mines produced sheet mica. The leading producers were Snow Hill Mining Co. (Spencer mine) and Lemmie and Curtis Mabe (Mabe mine).

Surry.—North Carolina Granite Corp. quarried dimension granite for rough and dressed construction stone, rough and dressed architectural stone, dressed monumental stone, and curbing and flagging. North Carolina Granite Corp. (Mount Airy quarry) and Ararat Products Co. produced granite for riprap, concrete, roads, poultry grit, and other uses. The State highway commission mined paving sand and gravel. Ruth P. Stanley collected a small quantity of gem stones. (citrine quartz).

Swain.—The Feldspar Corp. (Alexander mine) mined crude feldspar. Nantahala Talc & Limestone Co. (Hewitt quarry) crushed limestone for concrete, roads, and agstone.

Transylvania.—Seniard Brothers, Kermit Reese Country Club, Inc., and Coleman Scott mined structural sand and paving gravel. Macon Construction Co., Inc., quarried dimension granite for rubble and crushed granite for concrete and roads. James E. Moore (Fred Hall mine) and Jeter C. Kitchen (Toxoway mine) mined small quantities of sheet mica. Powhatan Mining Co. (Kilpatrick mine) mined asbestos. E. I. du Pont de Nemours & Co., Inc., produced high-purity silicon at Brevard.

Union.—Superior Stone Co. Division (Bakers quarry) and the State highway commission crushed traprock for concrete and roads. Kendrick Brick & Tile Co. (Monroe mine) mined miscellaneous clay for heavy clay products.

Vance.—W. E. Graham & Sons Division (Greystone quarry) produced granite for riprap, concrete, roads, and railroad ballast. Tungsten Mining Corp. (Hamme mine) shipped tungsten concentrate from stock. The State highway commission mined paving sand.

Wake.—Superior Stone Co. Division (Crabtree and Rolesville quarries) and Nello L. Teer Co. (Raleigh quarry) produced granite for riprap, concrete, roads, railroad ballast, and other uses. The State highway commission mined paving sand. Harley Hines collected a small quantity of gem stones (actinolite).

Washington.—The State highway commission mined 48,000 tons of paving sand.

Watauga.—The State highway commission mined 11,000 tons of paving gravel.

Wayne.—Nello L. Teer Co., Superior Stone Co. Division (Goldsboro mine), and the State highway commission mined structural and paving sand and miscellaneous gravel.

Wilkes.—Stone Mining Co. crushed granite for concrete and roads. The State highway commission mined paving sand. Tracy Higgins (Tracy mine), mined sheet and scrap mica and C. W. Ellis (Hoilman mine), and Mrs. R. C. Jennings (Elk Creek mine) mined sheet mica only. Blue Ridge Minerals Co. and Albert V. Topper collected various types of gem stones.

Wilson.—Superior Stone Co. Division (Neverson and Elm City quarries) crushed granite for concrete and roads. Five mines produced structural, paving, and fill sand. The leading producers were the State highway commission and Gray Concrete Pipe Co., Inc.

Yadkin.—Stone Mining Co. (Cycle quarry) crushed granite for concrete and roads. The State highway commission mined 16,000 tons of paving sand.

Yancey.—Thirty-six mines produced mica; 30 produced sheet only (full-trimmed and/or hand-cobbed), 5 scrap only, and 1 both sheet and scrap. The leading producers of sheet mica were Geouge & Allen (Barger mine) and Eugene and V. O. Adkins (Coletta mine). The leading producers of scrap mica were Deneen Mica Co. (Young Mica mine) and Hassett Mining Co. (Simpson mine).

The Feldspar Corp. (Webb, McCracken, Land's Creek, and McClain mines) mined crude feldspar. McCrary Construction Service Co. mined paving gravel. C. R. Wiseman (Wray mine) mined olivine. Herby Bolick and Floyd Wilson collected various types of gem stones.

The Mineral Industry of North Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota

By D. H. Mullen[1]

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MINERAL production in North Dakota in 1959 was valued at $67.6 million, a gain of $8.2 million, or 14 percent, over 1958. The mineral fuels—coal (lignite), natural gas, natural-gas liquids, and crude petroleum—represented 90 percent of the total value of all mineral production in the State, and petroleum accounted for 93 percent of the total gain in value. Increases in production were recorded for all mineral commodities except sand and gravel. The advance in production and value of lignite, although slight, marked the reversal of the downward trend of 7 to 10 percent a year that began in 1956.

Exploratory and development drilling in oilfields continued but at a lower rate; however, the overall success ratio remained high (64 percent), and new producing areas were established on the north and south ends of the Nesson anticline. The first successful well was completed in Dunn County (Lost Bridge field) and the new Rough Rider field was discovered in McKenzie County; other discoveries were made in Bottineau and Burke Counties.

TABLE 1.—Mineral production in North Dakota[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays[2]	54	$66	61	$79
Coal (lignite)	2,314	5,409	2,413	5,426
Gem stones	(3)	1	(3)	1
Natural gas ... million cubic feet	17,325	1,672	[4] 16,500	[4] 1,700
Petroleum (crude) ... thousand 42-gallon barrels	14,259	42,634	[4] 17,960	[4] 50,288
Pumice	11	11		
Sand and gravel	11,464	6,605	9,883	6,516
Stone	23	35	48	84
Value of items that cannot be disclosed: Clays (bentonite) and natural-gas liquids		3,012		3,555
Total North Dakota		[5] 59,445		67,649

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; included with "Value of items that cannot be disclosed."
[3] Weight not recorded.
[4] Preliminary figure.
[5] Revised figure.

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[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

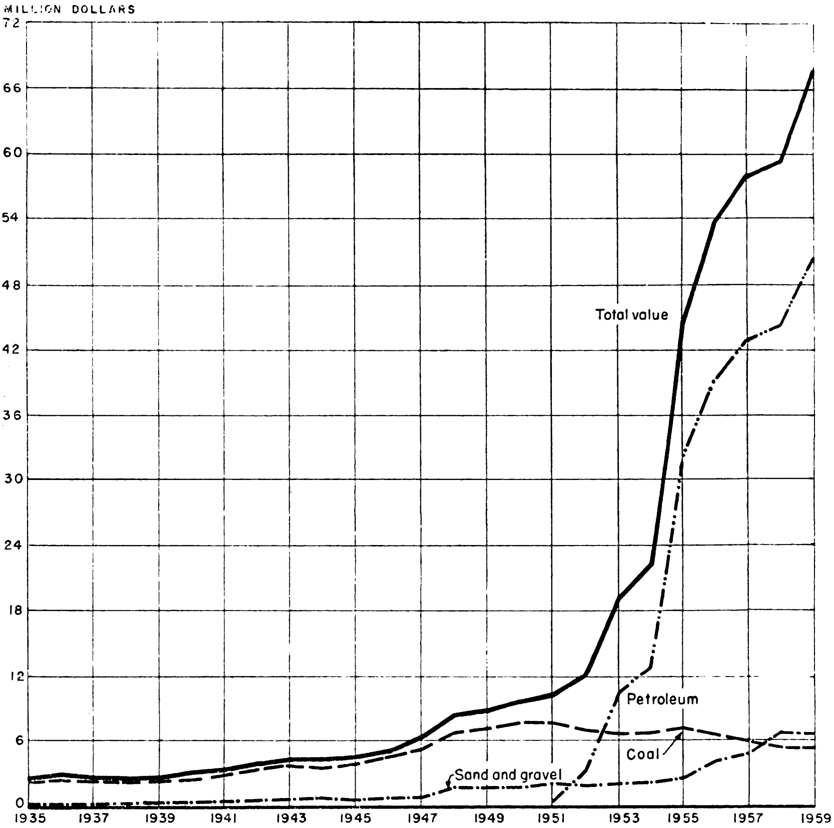

FIGURE 1.—Value of sand and gravel, petroleum, and coal, and total value of mineral production in North Dakota, 1935–59.

Employment.—Employment in the mineral industries in 1959 averaged 2,388 workers. The number employed in construction increased 14 percent and total nonagricultural employment increased 4 percent. It is interesting to note that the number of workers employed in December 1959, usually the low employment month, was greater in mineral production (2 percent), construction (19 percent), and nonagricultural activity (3 percent) than in December 1958.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—Coal production from 35 mines (34 strip and 1 underground) increased 4 percent over 1958 and reversed the downward trend that began in 1956. The use of coal for space heating, especially at State and Federal installations, had been increasing, and considerable attention was directed toward further utilization of lignite from the State's vast deposits. Representatives of numerous utility companies considered the feasibility of constructing thermal powerplants of 150,000- to 200,000- kw. capacity. The estimated savings over plants of smaller capacity could be as much as $30 per kilowatt. The plant would require a deposit of 100 to 150 million tons of coal adjacent to it and suitable for strip mining.

TABLE 2.—Production of coal (lignite), by counties
(Exclusive of mines producing less than 1,000 tons)

County	1958		1959	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Adams	29,269	$3.50	20,310	$3.53
Bowman	182,575	1.72	157,609	1.77
Burke	381,536	2.25	399,297	2.33
Burleigh	13,844	3.30	14,382	3.31
Divide	207,370	2.52	207,370	2.88
Dunn	9,682	2.97	6,135	2.91
Grant	26,469	3.15	24,305	3.23
Hettinger	7,270	2.91	6,811	3.39
McLean	97,485	3.00	91,560	3.24
Mercer	824,166	2.25	925,057	1.95
Morton	25,314	2.52	24,066	2.50
Oliver	9,119	2.49	10,748	2.46
Stark	56,944	2.62	62,953	1.81
Ward	439,766	2.36	458,764	2.33
Williams	3,049	4.73	3,251	4.72
Total	2,313,858	2.34	2,412,618	2.25

[1] Value received or charged f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Plans of North Dakota Nitrogen, Inc. (announced in 1958) to build a fertilizer plant at Riverdale and use the stockpiled lignite as a raw material apparently had been changed. The company was reported to be considering a location in the southeastern part of the State and the use of natural gas as a more suitable raw material. Husky Oil Co., of Cody, Wyo., purchased the Dickinson Briquetting Co. plant at Dickinson and planned to expand its facilities to include the production of charcoal briquets. The Great Northern Railway Co. continued its research on the use of North Dakota lignite in processing Minnesota taconite by establishing a project at the University of North Dakota. This was the second phase of an overall 5-year project; the first phase was conducted at the University of Minnesota where work was progressing on developing a process to utilize nonmagnetic taconite. Work continued at the Garrison Dam on powerplant units 4 and 5; completion, expected in 1961, will bring total installed capacity to 400 megawatts. The Federal Bureau of Mines continued its long-range research on lignite at the Charles R. Robertson Lignite Research Laboratory at Grand Forks. A report[2] covering a part of the work was published. A report[3] on methods of mining lignite also was published. The Square Buttes coal field in Oliver and Mercer Counties was described.[4]

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[2] Oppelt, W. H., Kube, W. R., and Kamps, T. W., Drying North Dakota Lignite to 1,500 Pounds Pressure by the Fleissner Process: Bureau of Mines Rept. of Investigations 5527, 1959, 30 pp.

[3] Van Sant, J. N., and Ellman, R. C., Methods and Costs of Mining Lignite in North Dakota: Bureau of Mines Inf. Circ. 7891, 1959, 82 pp.

Natural Gas.—Dry natural gas from 28 wells in 2 fields in Bowman County and residual gas from the Tioga gasoline plant in Williams County were marketed through pipelines of the Montana-Dakota Utilities Co. to consumers in North and South Dakota, Wyoming, and Montana. Gasfields in Bowman County, producing since 1928, were becoming depleted and the quantity of natural gas marketed in 1959 was 5 percent below that in 1958; the value, however, increased 2 percent. According to official reports[5] by the State geologist, the estimated production of oil-well gas was 22.4 billion cubic feet and of dry natural gas, 328 million cubic feet.

Natural-Gas Liquids.—Natural gasoline, propane, and butane were extracted from oil-well gas at the Tioga gasoline plant in Williams County by Signal Oil and Gas Co. Production statistics[6] by the State Geological Survey showed that 15 billion cubic feet of gas was processed to recover 10.6 million gallons of natural gasoline, 32 million gallons of propane, and 18.6 million gallons of butane. Residual gas marketed through pipelines of Montana-Dakota Utilities Co. totaled 8 billion cubic feet. Fifteen thousand tons of sulfur also was recovered.

Petroleum.—Petroleum production from 67 fields in 10 counties increased 26 percent in quantity and 18 percent in value compared with 1958, and 1,538 wells were producing at yearend. Exploratory and development drilling resulted in only 428 wells being completed compared with 454 in 1958. The State geologist[7] reported 63 exploratory wells completed, of which 6 were listed as discoveries; 48 outpost wells completed, of which 25 were successful; 64 extension wells completed, of which 46 were successful; and 4 stratigraphic

TABLE 3.—Production of crude petroleum in North Dakota, by counties[1]
(Thousands barrels)

County	1958	1959 (preliminary)	Principal fields in 1959 (in order of production)
Billings	368	366	Rocky Ridge, Fryburg, Scoria.
Bottineau	1,139	1,965	Newburg, South Westhope, Wiley, Roth, North Westhope.
Bowman	15	12	Little Missouri.
Burke	1,25	2,934	Rival, North Tioga, South Rival, Flaxton, Portal.
Divide	130	287	North Tioga, Noonan, Baukol-Noonan.
McKenzie	4,215	5,031	Blue Buttes, Antelope, Charlson.
Mountrail	1,588	1,479	Tioga, White Earth, East Tioga.
Renville	32	199	Sherwood, Glenburn.
Stark	33	72	Dickinson.
Williams	5,487	5,615	Beaver Lodge, Tioga, Capa.
Total	14,259	17,960	

[1] Based on North Dakota Geological Survey county data adjusted to Bureau of Mines total.

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[4] Johnson, W. D., Jr., and Kunkel, R. P., The Square Buttes Coal Field, Oliver and Mercer Counties, N. Dak.: Geol. Survey Bull. 1076, 1959, 91 pp.

[5] Laird, Wilson M., Oil in North Dakota, First Half 1959: North Dakota Geol. Survey Bull., August 1959, 88 pp.
Laird, Wilson M., Oil in North Dakota, Second Half 1959: North Dakota Geol. Survey Bull., March 1960, 89 pp.

[6] Work cited in footnote 5.

[7] Work cited in footnote 5.

TABLE 4.—Wildcat- and development-well completions in 1959, by counties

[The Oil and Gas Journal]

County	Crude	Condensate	Dry	Total	Footage (thousand)
WILDCAT					
Billings	1		2	3	27
Bottineau	7		17	24	88
Burke	9		14	23	156
Cavalier			2	2	5
Divide			6	6	48
Dunn	1		2	3	32
Hettinger			1	1	8
McHenry			5	5	18
McKenzie	1		3	4	43
Morton			1	1	5
Mountrail			1	1	9
Pierce			1	1	3
Ramsey			2	2	4
Renville			1	1	4
Rolette			1	1	3
Stark			1	1	10
Stutsman			1	1	3
Ward			2	2	14
Williams	1		1	2	21
Total wildcat	20		64	84	501
DEVELOPMENT					
Billings	4		1	5	42
Bottineau	70		38	108	395
Burke	89		32	121	812
Divide	10		7	17	128
McKenzie	57		3	60	568
Renville	11		6	17	73
Williams	12	5	7	24	267
Total development	253	5	94	352	2,285
Total, all drilling	273	5	158	436	2,786

tests. Development drilling accounted for 249 completions, of which 189 were successful. Success ratios were 9.5 percent for exploratory drilling and 76 percent for development drilling. The overall success ratio was 62 percent.

One discovery was credited to Dunn County where the No. 1 Signaless unit in the Lost Bridge field was completed in November, making Dunn the 12th county in the State with a successful oil well. Discovery of the Rough Rider field in McKenzie County in December was significant. Initial production was 1,526 barrels of oil a day from the Mission Canyon formation at a depth of 9,399 feet. Other discoveries included the Black Slough field in Burke County, discovered in May, and the South Starbuck, Starbuck, and Southwest Starbuck fields in Bottineau County, discovered in April. Drilling totaled 2.7 million feet compared with 2.8 million in 1958.

NONMETALS

Clays.—Miscellaneous clay was produced in Adams and Morton Counties for making building brick, draintile, and other heavy clay products. Lightweight aggregate was manufactured from shale produced in Divide and Morton Counties. Production of clay increased 13 percent in quantity and 20 percent in value over 1958. A small quantity of bentonite produced in Morton County was used in foundries and in manufacturing prepared mortar.

Gem Stones.—Individuals and gem societies collected gem material, including petrified wood, chalcedony, and jasper, in Billings, Morton, and Stark Counties.

Sand and Gravel.—Production of sand and gravel from 51 of the State's 53 counties declined 14 percent in quantity and 1 percent in value compared with 1958. Commercial sand and gravel produced in 38 counties at 78 operations represented 47 percent of the total production; it was used for building (18 percent), road construction (75 percent), and railroad ballast and fill material (7 percent). Government-and-contractor operations at 64 locations in 46 counties represented 53 percent of the total, all of which was used for road building and highway construction. Of the State's total output of 9.9 million tons of sand and gravel, 8.7 million tons or 88 percent was used for road building. Major production was reported from Cass (902,800 tons), Barnes (775,200 tons), Kidder (658,600 tons), and Stutsman (555,400 tons) Counties.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	313	$302	310	$376
Paving	339	245	202	192
Fill	61	32	96	67
Other	1	1	2	1
Total sand	714	580	610	636
Gravel:				
Building	290	558	514	834
Paving	1,649	998	3,291	2,132
Railroad ballast	104	44	190	85
Fill	50	20	44	21
Other	7	4	11	18
Total gravel	2,100	1,624	4,050	3,090
Total sand and gravel	2,814	2,204	4,660	3,726
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	70	70		
Paving	212	106	138	70
Total sand	282	176	138	70
Gravel:				
Building			44	27
Paving	8,368	4,225	5,041	2,693
Total gravel	8,368	4,225	5,085	2,720
Total sand and gravel	8,650	4,401	5,223	2,790
ALL OPERATIONS				
Sand	996	756	748	706
Gravel	10,468	5,849	9,135	5,810
Total	11,464	6,605	9,883	6,516

Progress in the construction of the National System of Interstate and Defense Highways and other Federal-aid projects, according to a report[8] by the U.S. Department of Commerce, Bureau of Public Roads, showed that 83 miles and 42 bridges of the national system were completed and 106.6 miles and 31 bridges were under construction at the end of the year.

Stone.—Crushed granite was produced by contractors for the State department of highways at various locations throughout North Dakota for use in highway construction. Miscellaneous stone was crushed for private highway construction in Bowman and Mercer Counties. The quantity produced was 41 percent above that in 1958.

Sulfur.—Shipments of sulfur from the natural-gasoline plant at Tioga totaled 14,055 long tons, a 15-percent gain over 1958. The value of recovered sulfur is not included in the State total of mineral production because of the difficulty of assigning the State or county of origin to sulfur recovered from natural gas and petroleum at some plants.

Vermiculite.—An exfoliation plant in Ward County processed crude vermiculite from deposits in Montana for use as insulation, lightweight aggregate, and soil conditioner.

METALS

Uranium.—No activity was reported in the exploration or development of uraniferous lignite deposits during the year. Proposals to construct a processing plant for the extraction and sale of uranium oxide to the Atomic Energy Commission (AEC) had not been approved.

REVIEW BY COUNTIES

Barnes.—Production of sand and gravel by contractors for the State highway department (185,500 tons) and by the county highway department (316,100 tons), for construction, repair, and maintenance of highways, and by three commercial operators (273,600 tons), also for highway construction, increased 58 percent over 1958. The county ranked second in the State in the output of sand and gravel (third in 1958).

Billings.—Petroleum production from 28 wells in 5 fields declined slightly compared with 1958. Increased output came from the Fryburg and the Rocky Ridge fields; the greatest decline was in the Scoria field. Nine new producing wells were completed in the Fryburg field, all in the Heath sandstone. Contractors supplied 10,000 tons of sand and gravel for the State highway department.

Bottineau.—Petroleum production, from 206 wells in 17 fields, increased 73 percent over 1958. Discoveries included the North Hass field, adjacent to the Hass field, and the Starbuck, South Starbuck, and Southwest Starbuck fields. Boundaries of the Starbuck, South Starbuck, and Southwest Starbuck fields are contiguous; however, the discovery wells were more than 1 mile apart. The Starbuck field produced from the Spearfish-Charles formation and the South and Southwest Starbuck fields from the Madison limestone. Major producing fields were the Newburg, South Westhope, and Wiley; the last-named field was a 1958 discovery. The county ranked fourth

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[8] Bureau of Public Roads, Status of Federal-Aid Highway Programs, December 1959: Press release BPR 60–3.

TABLE 6.—Value of mineral production in North Dakota, by counties[1]

County	1958	1959[2]	Minerals produced in 1959 in order of value
Adams	$103,185	$92,635	Coal, sand and gravel, clays.
Barnes	215,000	361,700	Sand and gravel.
Benson	177,300	133,400	Do.
Billings	1,100,420	1,030,100	Petroleum, sand and gravel, gem stones.
Bottineau	3,405,610	5,503,200	Petroleum, sand and gravel.
Bowman[3]	361,611	317,713	Coal, petroleum, sand and gravel, stone.
Burke[4]	4,632,950	9,161,892	Petroleum, coal, sand and gravel.
Burleigh	179,827	451,743	Sand and gravel, coal.
Cass	138,700	452,700	Sand and gravel.
Cavalier	102,000	166,600	Do.
Dickey	199,900	78,700	Do.
Divide	1,048,005	1,501,356	Petroleum, coal, sand and gravel, clays.
Dunn	149,350	24,155	Coal, sand and gravel.
Eddy	307,800	221,300	Sand and gravel.
Emmons	38,000	158,100	Do.
Golden Valley	--------	5,000	Do.
Grand Forks	208,100	179,400	Do.
Grant	131,934	83,517	Coal, sand and gravel.
Griggs	151,900	8,000	Sand and gravel.
Hettinger	27,656	30,971	Coal, sand and gravel.
Kidder	3,100	(5)	Sand and gravel.
LaMoure	46,300	8,300	Do.
Logan	71,800	117,500	Do.
McHenry	26,700	104,500	Do.
McIntosh	201,700	207,200	Do.
McKenzie[4]	[6] 12,614,049	14,122,600	Petroleum, sand and gravel.
McLean	398,273	437,518	Coal, sand and gravel.
Mercer	1,854,476	1,837,969	Coal, sand and gravel, stone.
Morton	220,926	303,374	Sand and gravel, coal, clays, gem stones.
Mountrail[4]	4,960,420	4,193,500	Petroleum, sand and gravel.
Nelson	212,800	30,500	Sand and gravel.
Oliver	49,903	74,817	Sand and gravel, coal.
Pembina	249,900	86,900	Sand and gravel.
Pierce	6,200	23,200	Do.
Ramsey	53,100	56,200	Do.
Ransom	7,200	23,800	Do.
Renville	106,280	561,100	Petroleum, sand and gravel.
Richland	169,400	80,400	Sand and gravel.
Rolette	61,200	31,800	Do.
Sargent	192,000	71,300	Do.
Sheridan	168,600	30,200	Do.
Sioux	39,200	36,200	Do.
Stark	378,021	454,088	Petroleum, sand and gravel, coal, gem stones.
Steele	23,100	91,500	Sand and gravel.
Stutsman	149,000	606,900	Do.
Towner	140,900	3,800	Do.
Traill	129,800	142,500	Do.
Walsh	181,200	119,500	Do.
Ward	1,765,312	1,436,465	Coal, sand and gravel.
Wells	14,300	148,200	Sand and gravel.
Williams[4]	[6] 16,699,553	15,956,845	Petroleum, sand and gravel, coal.
Undistributed[7]	[6] 5,571,200	6,287,800	
Total	[6] 59,445,000	67,649,000	

[1] The following counties are not listed because no production was reported: Foster and Slope.
[2] Values of coal, natural gas, natural-gas liquids, and petroleum are preliminary.
[3] Excludes natural gas.
[4] Excludes natural gas, natural-gas liquids, and recovered elemental sulfur.
[5] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[6] Revised figure.
[7] Includes all natural-gas liquids, natural gas, stone (1958), some sand and gravel, stone (1959), and value indicated by footnote 5.

in the State in petroleum production with an output of nearly 2 million barrels.

Bowman.—Petroleum production from the Little Missouri field declined slightly from 1958, and natural-gas production from 28 wells in the Cedar Creek and Little Missouri fields also was less. The natural gas, from the Eagle sandstone, was marketed through pipelines of the Montana-Dakota Utilities Co. The Knife River Coal Co. operated its Peerless strip mine at Gascoyne and also produced partly fused shale for road construction. Sand and gravel (7,600 tons) was produced by contractors for the State highway department.

Burke.—The county ranked third in the State in value of coal (lignite) and petroleum production in 1959. Coal output from the Kincaid strip mine, operated by Truax-Traer Coal Co., and the Bonsness strip mine increased 5 percent over 1958, and petroleum production from 232 wells in 18 fields doubled. Major fields were Rival, North Tioga, South Rival, Flaxton, and Portal; new discoveries were the Northeast Foothills and Black Slough fields. Other reported discoveries were classified as extensions of existing fields. Sand and gravel for building and highway construction was produced by contractors (5,400 tons) for the State highway department, the county highway department (5,800 tons), and Sandberg Construction Co. (39,100 tons).

Cass.—The county led the State in output of sand and gravel for buildings and highway construction. Major producers were Roy Scheffler (286,800 tons) and Schultz & Lindsey Gravel Co. (291,900 tons). Contractors produced paving gravel (86,600 tons) for the State highway department.

Divide.—Petroleum production from 25 wells in 4 fields was double that of 1958. The greatest increase was in the North Tioga field where nine new producing wells were completed. Output in the Noonan and Baukol-Noonan fields also increased. Baukol-Noonan, Inc., produced coal (lignite) at its Baukol-Noonan strip mine at Noonan and also produced shale for making lightweight aggregate. The county ranked fourth in the State in coal production. Building and paving gravel (5,200 tons) were produced by Susag Sand & Gravel. Contractors produced paving gravel (17,600 tons) for the State highway department. The county highway department produced 56,900 tons of gravel for road repairs.

Dunn.—The county became the 12th in the State to produce petroleum when the Lost Bridge field was discovered in November 1959; initial output was 313 barrels of oil a day from the Duperow formation at a depth of 11,428 to 11,484 feet. Coal (lignite) was produced at the Sampson and Pelton strip mines. Contractors produced 12,700 tons of paving gravel for the State highway department.

Kidder.—The county ranked third in the State in production of sand and gravel. Output, all by Hallett Construction Co. (163,500 tons) and contractors (495,100 tons) for the State highway department, was used entirely for road construction.

McKenzie.—Petroleum production from 348 wells in 14 fields increased 19 percent compared with 1958, and the county continued to rank second in the State in output. Major producing fields were Blue Buttes, Charleston, Antelope Spanish, and Antelope Madison. One new field, Rough Rider, discovered in December, had an initial production potential of 1,526 barrels of oil a day from the Mission Canyon formation at a depth of 9,399 feet. Sand and gravel (71,200 tons) was produced by the county highway department for road construction.

McLean.—Coal (lignite) output, from three strip mines, declined 6 percent compared with 1958. Major producers were Truax-Traer Coal Co. at the Custer strip mine and Underwood Coal Co. at the

Underwood strip mine. Schultz & Lindsey Gravel Co. produced 236,100 tons of paving gravel. Contractors produced 30,400 tons of sand and gravel for the State highway department. The county highway department produced 37,200 tons of sand and gravel for road repairs.

Mercer.—Output of coal (lignite) from four strip mines was 12 percent greater than in 1958, and the county continued to lead the State in production. The Knife River Coal Co. operated the Knife River strip mine; Truax-Traer Coal Co. the Dakota Star Mine; and North American Coal Corp. the Indian Head strip mine. Missouri Sand and Gravel Co. produced building and paving sand and gravel.

Morton.—Production of coal (lignite) from four strip mines declined slightly compared with 1958; principal producers were Timpe & Niles Coal Co. and Kaelberer Coal Co. Hebron Brick Co., producer of miscellaneous clay for manufacturing building brick, draintile, and other heavy clay products, began a modernization program which included building a drier and tunnel kiln that would increase daily capacity from 30,000 to 70,000 bricks. Plans were announced to manufacture a line of specialized brick products. A small quantity of bentonite was produced for use in foundries and in manufacturing prepared mortar. Standard Oil Co. of Indiana operated its Mandan refinery the entire year, and during September the plant processed an average of 40,974 barrels of crude oil a day. Throughput in 1959 was 13.7 million barrels of crude oil, a 14-percent increase over 1958. Contractors produced 102,200 tons of sand and gravel for the State highway department. The county highway department and the city of Mandan produced sand and gravel for road repair. Four commercial operators produced 84,100 tons of sand and gravel for building, road construction, and fill. Molite, Inc., produced shale for making lightweight aggregate.

Mountrail.—Production of petroleum from 141 wells in 3 fields declined 7 percent from 1958, and the county ranked fifth in the State in output. Major production came from 107 wells in the part of the Tioga field lying within the county and from 25 wells in the White Earth field. Sand and gravel (88,800 tons) was produced by the Great Northern Railway Co., Schultz & Lindsey Gravel Co., and contractors for the State highway department.

Renville.—Production of petroleum from 15 wells in the Sherwood and Glenburn fields, discovered in 1958, increased sixfold. Development drilling added 11 producing wells to the 2 fields, 7 in the Sherwood and 4 in the Glenburn fields.

Stark.—Production of coal (lignite) from three strip mines in Stark County increased 11 percent compared with 1958. Dickinson Coal Mining Co. operated the Lehigh and Dickinson mines, and output from the Lehigh was used in manufacturing briquets. Valentine Walter operated the Walter mine. Petroleum production from the Heath sandstone and Madison limestone pools in the Dickinson field declined 78 percent compared with 1958. Pacific State Oil Co. of Billings, Mont., purchased the Queen City oil refinery at Dickinson, in bankruptcy proceedings, at less than 75 percent of the appraised value and planned to reopen the plant in 1960. Three operators produced 98,500 tons of sand and gravel for building, road construction, and fill material, and contractors produced 7,800 tons of sand and gravel for the State highway department.

Ward.—Coal (lignite) production at four strip mines increased 4 percent compared with 1958; major producers were Truax-Traer Coal Co. at the Velva strip mine; Valley Coal Co. at the Valley strip mine; and Sawyer Fuels, Inc., at the Miller strip mine. Contractors produced sand and gravel for the State highway department; the county highway department produced 64,200 tons of sand and gravel for road repairs and maintenance. Sand and gravel (250,000 tons) for building, road construction, railroad ballast, and fill material was produced by four operators, including Atlas Sand & Gravel Co. and Minot Sand and Gravel Co. Robinson Insulation Co. operated an exfoliation plant at Minot and processed crude vermiculite from deposits in Montana. The principal use of the product was as insulation; small quantities were used as a lightweight aggregate and for soil conditioning.

Williams.—Petroleum production from 504 wells in 8 fields inincreased 2 percent over 1958 and Williams County continued to lead the State in output. Major producing fields were Beaver Lodge, Tioga, and Capa. All three fields produced oil from the Madison limestone; also, the Beaver Lodge field produced oil from the Devonian pool. The North Tioga field was extended into the county from Divide County where it was discovered in 1957. Westland Oil Co. operated its 2,000-barrel-a-day refinery at Dickinson all year with a throughput of 768,085 barrels of crude oil, an increase of 5 percent over 1958.

Signal Oil Co. operated its No. 12 natural-gasoline plant at Tioga the entire year and extended gathering lines to the South Blue Buttes area. Additional connections were planned for 1960. Expansion of field booster facilities, completed in 1959, substantially aided the gathering of gas for the plant. Total gas processed through December 1959 was 66.7 billion cubic feet. Natural-gas liquids recovered were 46.8 million gallons of natural gasoline, 76.6 million gallons of butane, and 134.4 million gallons of propane. Sales of residual gas totaled 29.3 billion cubic feet, and 57,788 long tons of sulfur was recovered. Coal (lignite) production from the Black Diamond underground mine (the only one in the State) increased 7 percent over 1958.

Construction of a $2 million salt plant was begun near Williston by Dakota Salt and Chemical Co., a subsidiary of General Carbon and Chemical Corp. The salt was to be recovered from deep wells by solution mining. It was planned to use the large caverns created by removal of the salt for storage of liquid-petroleum gases. Sand and gravel (53,300 tons) for building, paving, and fill material was mined by three operators. Contractors produced 146,600 tons of sand and gravel for the State highway department for road construction and repairs and 88,300 tons for the county highway department.

The Mineral Industry of Ohio

By Joseph Krickich,[1] Stanley A. Feitler,[1] and Roy H. Davis[2]

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THE VALUE of Ohio's 1959 mineral production reached a new high of $395.9 million, a 15-percent increase over 1958 and $12.9 million more than in 1957, the previous record year. Increased demand by the construction and iron and steel industries resulted in higher output of coal, cement, stone, sand and gravel, and lime, the State's principal minerals. The year was highlighted by continuing expansion of the State's mineral-producing capacity, notably in cement, lime, and salt. Ohio led in output of lime and clay and ranked fifth in coal and salt. In addition, the State was a leading producer of iron and steel, ferroalloys, and blast-furnace slag.

TABLE 1.—Mineral production in Ohio[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thouands)
Abrasive stones .... short tons	852	$83	1,081	$101
Cement:				
Portland .... 376-pound barrels	14,960,087	50,092	18,140,723	60,560
Masonry .... do	739,728	2,951	853,328	3,374
Clays	5,220	13,082	5,479	15,346
Coal	32,028	126,241	35,112	135,729
Gem stones	(2)	(3)	(2)	2
Lime	2,411	32,471	3,190	45,121
Natural gas .... million cubic feet	31,786	6,802	[4] 31,900	[4] 7,800
Peat	5,660	104	5,813	73
Petroleum (crude) .... thousand 42-gallon barrels	6,260	18,091	[4] 5,566	[4] 15,974
Salt (common)	2,443	17,443	2,858	20,486
Sand and gravel	29,624	36,619	38,604	45,138
Stone	29,122	49,782	[5] 36,155	[5] 59,326
Value of items that cannot be disclosed: Gypsum, marl (calcareous) (1959), and natural gasoline (1958)		1,905		2,029
Total Ohio[6]		344,856		395,901

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Quantity not recorded.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Excludes certain stone, value for which is included with "Value of items that cannot be disclosed."
[6] Totals have been adjusted to avoid duplicating the value of limestone, clays, and calcareous marl used for manufacturing cement and lime.

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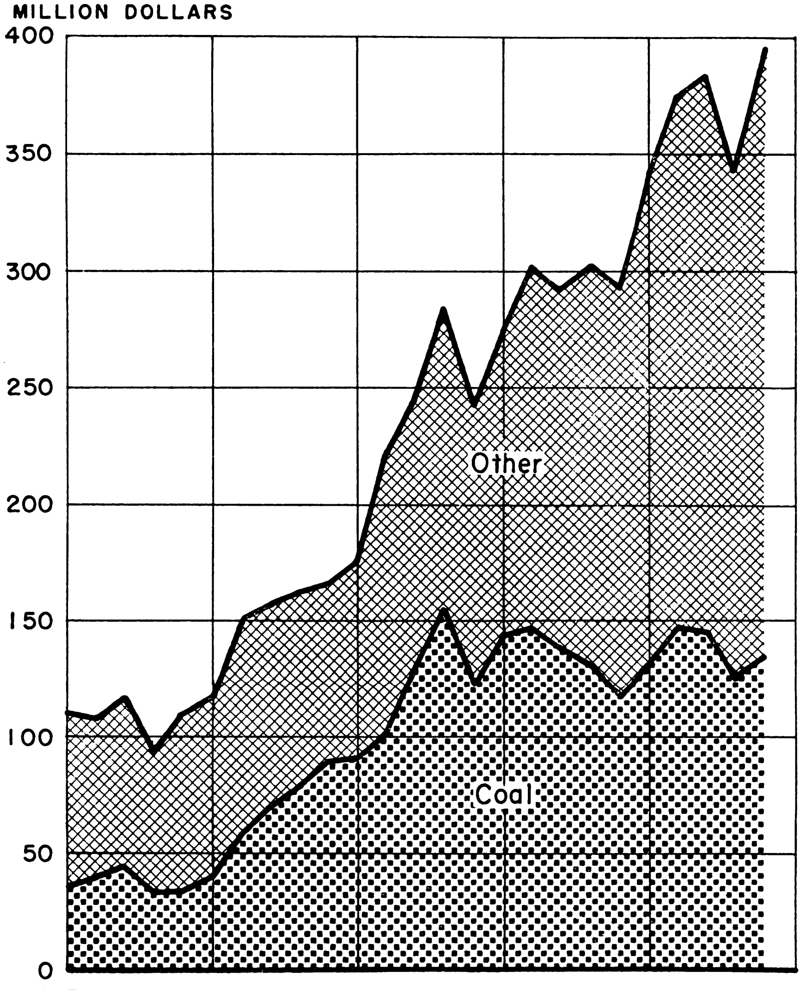

FIGURE 1.—Value of coal and total value of mineral production in Ohio, 1935–59.

Employment and Injuries.—Excluding officeworkers and all employees in the petroleum and natural-gas industry, 50.8 million man-hours were worked in the mineral industries according to preliminary data. The injury experience in selected industries improved over 1958. A total of 10 fatal and 715 nonfatal lost-time injuries was recorded in 1959. The biggest improvement was in the coal industry, where the number of fatal and nonfatal injuries decreased from 10 and 350, respectively, in 1958, to 4 and 340 in 1959. In addition, the State's coal mines had the lowest injury rate per million man-hours for fatal and nonfatal injuries, 0.25 and 21.49, which was well below the national average of 0.91 for fatal and 41.4 for nonfatal.

The Genoa plant (Ottawa County) of U.S. Gypsum Co. and the Woodville plant (Sandusky County) of Standard Lime & Cement Co. Division of American-Marietta Co., ranked first and second, respectively, in the National Lime Association Safety Competition. These two plants worked 795,000 man-hours without a lost-time injury and were awarded Certificates of Achievements in Safety by the Federal Bureau of Mines. Other companies also achieved injury-free operations in 1959. The Ironton mine (Lawrence County) of Alpha Portland Cement Co., ranked fifth in the nonmetal group of National Safety Competition. The Lowellville quarry (Mahoning County) of Carbon Limestone Co., ranked second in the quarry group of National Safety Competition. Both of these plants were awarded Certificates of Achievement in Safety for sustaining injury-free operations.

TABLE 2.—Employment and injuries for selected mineral industries in 1959 [1] [2]

Commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Number of injuries per million man-hours	
			Fatal	Nonfatal	Fatal	Nonfatal
Coal	8,600	15,820,000	4	340	0.25	21.49
Coke ovens	2,488	6,583,000	1	7	.15	1.06
Clays	3,000	5,706,000	----------	152	----------	26.64
Nonmetals [3]	682	1,409,000	----------	11	----------	7.81
Quarries and mills [4]	6,771	15,856,000	3	149	.19	9.40
Sand and gravel [5]	2,703	5,409,000	2	56	.37	10.35

[1] Preliminary data.
[2] Production employees.
[3] Includes grindstones, gypsum, and salt.
[4] Includes cement and lime plants having no quarry operations.
[5] Commercial producers only.

Trends and Developments.—Indicative of the continuing growth of mineral industries in Ohio were expansions in the aluminum, cement, lime, salt, and petroleum and natural-gas industries. A newly constructed cement plant at Barberton began operations late in 1959. Development of a new underground rock-salt mine in Lake County was completed and production was started, and development of another underground rock salt mine at Cleveland continued. It was the first full year of aluminum production at the new reduction plant near Clarington, and an aluminum rolling mill adjacent to the plant was completed and in production for most of 1959. Exploratory and development drilling by petroleum and natural-gas producers was at a record pace and interest in offshore development of Lake Erie continued. The city of Dayton was the first municipality in Ohio to recover lime by treatment of waste sludge and recarbonation of treated water at its water softening and treatment plant.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Grindstones were produced by three operators. Most of the output was quarried in Washington County near Marietta and Constitution, and a smaller quantity was mined at Kipton in Lorain County.

Cement.—Production, shipments, and value of portland and masonry cements increased, reflecting increased building and construction activity throughout the State. Although plants operated at only 77 percent of capacity (71 percent in 1958), a record year was established, as shipments from plants increased 2.7 million barrels over the previous peak year of 1957. Value per barrel for both portland and masonry cement declined. Greene County continued as the leading cement-producing area.

The principal raw materials used for manufacturing portland cement were limestone, cement rock, and calcareous marl of which 4.8 million tons were consumed at 11 plants. In addition, the following tonnages of raw materials were used: clay and shale, 822,000 tons; gypsum, 133,000; sand and sandstone, 33,000; and iron materials, 22,000. Grinding aids and air-entraining compounds also were utilized. Types of portland cement produced included types I–II (general use), type II (high-early-strength), and waterproof.

The bulk of the cement was consumed in Ohio and neighboring States. A percentage breakdown by types of customers of 10 of the 11 portland-cement producers was as follows: ready-mix concrete companies, 51 percent; highway and other contractors, 18 percent; concrete product manufacturers, 17 percent; and building material dealers, 13 percent. Less than 1 percent was shipped to Federal, State, and local government agencies and miscellaneous customers. Seventy-nine percent of the finished portland cement was shipped by truck, and the remainder by rail; 87 percent was shipped to consumers in bulk, and the remainder in paper bags.

On December 31, 1959, annual finished cement capacity was 23.4 million barrels, 9 percent higher than the preceding year. Of the total capacity, 71 percent was wet-process and 29 percent, dry-process. The plants consumed 433.1 million kilowatt-hours of electrical energy, of which 239.8 million kilowatt-hours was purchased from public utilities.

The 1.5 million-barrel cement plant of Columbia-Southern Chemical Corp. at Barberton was completed late in the year, and initial production was begun in December. The main features of the plant included a 450- by 13-foot rotary kiln and nine cement-storage silos (capacity, 180,000 barrels). Consolidated Cement Corp., which operated a plant at Paulding, and General Portland Cement Co. merged during the year. Pittsburgh Coke & Chemical Co. began constructing a $250,000 cement-distribution plant near Marietta. Facilities to be included in the plant were a self-unloading barge, docks, three storage silos, and equipment for bulk loading of trucks. Cement barged down the Ohio River from the company plant near Pittsburgh, Pa., was to supply the plant.

Clays.—Increased activity of the refractories-consuming and construction industries resulted in a 5-percent increase in output of clay. The increase was attributed mainly to a greater demand for clay used in manufacturing heavy clay products, refractories, and cement, the principal uses. A slight decline was recorded in output of clay for floor and wall tile and lightweight aggregate. Miscellaneous clay or

TABLE 3.—Finished portland cement produced, shipped, and in stock

Year	Number of active plants	Production (thousand barrels)	Shipments from mills: Barrels (thousands)	Shipments from mills: Value (thousands)	Stocks at mills on December 31 (thousand barrels)
1950-54 (average)	9	11,919	11,874	$30,177	840
1955	9	13,966	13,982	39,643	839
1956	10	15,722	15,151	46,342	1,293
1957	10	16,291	15,454	49,115	1,974
1958	10	15,191	14,960	50,092	2,115
1959	11	18,028	18,141	60,560	1,904

shale accounted for 57 percent of the total clay output; the remainder was fire clay used mainly in refractories. The 116-day steel strike did not affect output of clays for refractories, as all major refractory uses increased. Fire clay was produced in 17 counties; the greatest output was from Tuscarawas and Stark. Miscellaneous clay was produced in 36 counties; Cuyahoga and Tuscarawas Counties led in output.

TABLE 4.—Clays sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Cuyahoga	317,716	$269,816	353,570	$311,574
Delaware	(1)	(1)	73,317	97,638
Hocking	(1)	(1)	44,635	151,945
Holmes	95,661	213,253	92,943	255,955
Jackson	99,676	604,979	133,465	(1)
Jefferson	90,318	(1)	129,000	866,650
Lawrence	(1)	885,696	153,391	816,695
Marion	(1)	(1)	202,800	254,200
Muskingum	(1)	(1)	14,578	20,558
Paulding	(1)	(1)	25,026	45,182
Perry	298,049	(1)	322,014	774,361
Putnam	21,524	24,330	23,920	26,862
Scioto	9,770	112,605	(1)	(1)
Seneca	7,500	7,500	18,500	22,500
Stark	639,690	(1)	614,539	1,690,007
Tuscarawas	1,018,055	2,989,428	1,063,636	3,926,496
Van Wert	6,277	8,436	8,477	14,984
Vinton	40,963	81,926	28,391	85,204
Washington	518	829	(1)	(1)
Wood	1,351	1,351	(1)	(1)
Undistributed [2]	2,572,483	7,881,869	2,176,394	5,985,032
Total	5,219,551	13,082,018	5,478,596	15,345,843

[1] Figures withheld to avoid disclosing individual company confidential data.

[2] Includes data for the following counties: Ashland, Athens, Carroll, Columbiana, Darke, Franklin, Hancock, Harrison, Henry, Highland, Madison, Mahoning, Medina, Noble, Portage, Richland, Summit, Wayne, Williams, and Wyandot; clays used in cement manufacturing not apportioned by counties; and data indicated by footnote 1.

Gem Stones.—Value of gem stones and mineral specimens recovered by amateur collectors rose sharply, owing to increased coverage of the industry by the Federal Bureau of Mines. Specimens included agate, barite, calcite, celestite, flint, jasper, sphalerite, strontianite, and various other specimens, collected mainly in Licking and Ottawa Counties.

Gypsum.—Production and value of crude gypsum declined slightly, compared with 1958. Two mines in Ottawa County continued as the State's only source of gypsum. Output was calcined at nearby plants for use in manufacturing finished building products. National Gypsum Co. announced plans for constructing a plant at Lorain to produce wallboard, plaster, and other gypsum products.

Iron Oxide Pigments.—Iron oxide pigments were manufactured at Copley (Summit County) by Minnesota Mining and Manufacturing Co. from pyrite cinders shipped from Delaware and iron ore shipped from other States.

Lime.—Ohio continued as the Nation's leading lime-producing State. Total output increased because of increased demand for refractory lime used in steel mills and greater demand for building, chemical, and industrial lime. Output of agricultural lime declined for the sixth consecutive year. Quicklime accounted for 82 percent of the total lime output; the remainder was hydrated. Twenty plants in 12 counties were active, compared with 18 plants in 1958. Production was centered mainly in Sandusky County, which accounted for 29 and 34 percent of total output and value, respectively. Companies utilized shaft-type kilns predominantly; hydrators were mainly batch and continuous types. In addition, five atmospheric and four pressure hydrators were used. Fuels used at plants included bituminous coal, coke, natural and producer gas, and carbon monoxide. Shipments of lime were made to all States except Hawaii, Idaho, and Utah. Exports were made chiefly to Canada, and lesser amounts to Mexico, Chile, Bahama Islands, Germany, and India.

Indicating a new trend in water purification and softening, the Water Department of Dayton installed a $1.5 million lime plant, which recovered lime from formerly wasted sludge of treated water and by precipitation from hard water. The plant was one of four in the United States using this method of lime recovery and the only plant of its kind in Ohio. Quicklime was recovered in a 9.5- by 265-foot rotary kiln, fired by natural gas. The plant's capacity exceeded requirements of the city government. Thus, operating costs were lowered and added revenue was realized as the Water Department discontinued lime purchases and was able to sell surplus output to other softening plants.

TABLE 5.—Lime (quick and hydrated) sold or used by producers

(Thousand short tons and thousand dollars)

Year	Agricultural (burned)		Building		Chemical and other industrial		Refractory		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	55	$652	581	$8,288	640	$5,799	1,151	$15,355	2,427	$30,094
1955	44	544	639	10,353	1,087	9,828	1,269	18,669	3,039	39,394
1956	37	542	577	9,575	968	8,612	1,413	22,076	2,995	40,805
1957	35	482	510	9,049	918	8,411	1,300	20,441	2,763	38,383
1958	34	481	474	7,539	1,007	9,977	896	14,474	2,411	32,471
1959	31	427	492	9,249	1,563	17,484	1,104	17,961	3,190	45,121

Perlite (Expanded).—Output and value of expanded perlite decreased as one less plant was active. Plants in Cuyahoga and Summit Counties continued to process crude perlite shipped from Western States for use as plaster and concrete aggregate, soil conditioner, and other purposes. Schumacher Industries, Inc., discontinued production in Montgomery County.

Salt.—An increase of 17 percent in total output of salt was due primarily to initial rock-salt production from the underground Fairport mine of Morton Salt Co. in Lake County. Output of evaporated salt and brine also increased. Evaporated salt, produced mainly by the vacuum-pan process, was sold to a wide variety of users including feed dealers, meatpackers, tanners, casing manufacturers, grocers, and soap and detergent manufacturers. The brine was consumed by producers mainly for manufacturing chlorine and soda ash. The State's salt industry operated at 74 percent of capacity, compared with 73 percent in 1958. Lake County replaced Summit County as the leading salt-producing area; other salt-producing counties were Meigs and Wayne.

Development of the International Salt Co.'s underground salt mine near Cleveland continued. Surface structures at the mine were completed, and installation of machinery was begun. Sinking of the production and surface shafts reached the 1,300-foot level, where water-bearing strata were encountered. The two shafts will be sunk to about 2,000 feet, and the mine level will be at about 1,850 feet. It was anticipated that development would be completed and production begun by mid-1960.[3]

Sand and Gravel.—Production reached a record high of 38.6 million tons valued at $45.1 million. The construction industry utilized 86 percent of the total as continued growth in the volume of building and highway construction resulted in a 19-percent increase in output of commercially produced material for this market. Tonnage of sand and gravel reported for noncommercial (Government-and-contractor) operations was much larger than in 1958 because of improved response to the canvass. Sand produced for industrial applications was valued at almost $5 million. The principal uses, in order of decreasing value, were for ferrous and nonferrous molding, glass manufacturing, and furnace construction and repair. Other applications included ferrosilicon manufacturing, blasting, engine, filtration, and grinding and polishing. Gains in production were recorded in 1959 for all categories of industrial sand except filtration. A quantity of the sand was prepared by grinding.

Active commercial operations totaled 374. These covered a wide range of sizes, from the well-designed, highly mechanized plant selling ready-mix concrete as well as washed and sized sand and gravel to the small pit from which bank-run material was shoveled by hand into the buyer's truck. Among the larger operations in the State were 11 plants that produced more than 500,000 tons. Of these, the largest produced 2.6 million tons, and the next two produced 1.6 million tons each. An average of 2,704 full-time production employees worked 5.4 million hours, producing 6.7 tons per man-hour. Average productivity ratio for the State's five largest plants, which produced only prepared sand and gravel, was 11.4 tons per man-hour. Commercial plants washed, screened, or otherwise prepared 91 percent of the sand and gravel produced. Shipments were 90 percent by truck, 7 percent by rail, and 3 percent by waterway. Only 19 percent of noncommercial output was prepared, as most of the material was used as fill and base material for roads.

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[3] International Salt Co., 1959 annual report.

TABLE 6.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	5,030	$5,836	6,118	$7,267
Paving	5,659	5,872	6,912	7,081
Fill	445	276	973	680
Molding	305	1,041	434	1,637
Filtration	72	118	20	50
Railroad ballast	17	13	-----	-----
Other [1]	609	2,182	1,036	3,073
Gravel:				
Building	5,167	6,418	5,774	7,066
Paving	9,808	11,747	11,819	13,673
Railroad ballast	328	271	209	170
Fill	564	567	845	596
Other	1,432	2,128	2,076	2,856
Total sand and gravel	29,436	36,469	36,216	44,149
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Paving	44	20	253	144
Other	-----	-----	86	19
Gravel:				
Building	6	17	-----	-----
Paving	138	113	930	671
Fill	-----	-----	1,119	155
Total sand and gravel	188	150	2,388	989
Grand total	29,624	36,619	38,604	45,138

[1] Includes the following sands: Glass, grinding and polishing, blast, fire or furnace, engine, ferrosilicon (1959), ground, and other.

Slag (Iron-Blast-Furnace).—Despite a 116-day steel strike, which stopped production in midyear, output of processed iron-blast-furnace slag decreased only slightly, dropping to 5.4 million tons from 5.8 million tons in 1958. Value declined less than 1 percent and totaled $10.7 million. Screened air-cooled blast-furnace slag was processed at 18 plants; granulated slag, at 5 plants; and lightweight (expanded) slag, at 5 plants. Of the total processed slag, 76 percent was screened, air-cooled material, compared with 75 percent in 1958. The State continued to rank second to Pennsylvania in output of processed slag.

Stone.—Output and value of stone (limestone, sandstone, and calcareous marl) increased in both tonnage and value. Greater road-construction activity and high operating levels of the iron and steel industry during the first 6 months of the year resulted in increased output of stone used for aggregate, flux, and gannister. In addition, limestone consumption by the cement and lime industries increased. Although total output of dimension stone (mostly sandstone) declined

4 percent, value increased 7 percent, due chiefly to higher unit values in 1959. Dimension sandstone was marketed as rough construction stone, rough and dressed stone, curbing, flagging, and rubble. Some dimension sandstone was sold for refractory use as furnace lining. Output of crushed and broken stone for all major uses increased. Output of calcareous marl used exclusively in manufacturing cement in Erie County declined.

Stone was produced in 61 counties, compared with 55 counties in 1958, and over 90 percent of the total output was limestone. Of the 54 limestone-producing counties, Sandusky, Erie, and Franklin led, in order of decreasing output. Sandstone was produced in 13 counties. Major producing counties were Lorain, Scioto, Portage, and Geauga.

TABLE 7.—Crushed and broken limestone sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Riprap	48, 863	$50, 172	156, 694	$132, 217
Concrete aggregate and roadstone	13, 332, 065	17, 462, 523	16, 742, 509	21, 904, 098
Fluxing stone	3, 845, 022	5, 411, 753	4, 947, 164	7, 560, 302
Agriculture	1, 678, 488	2, 650, 683	1, 871, 609	3, 145, 579
Railroad ballast	668, 752	751, 672	992, 521	1, 191, 701
Miscellaneous uses	8, 703, 898	14, 665, 781	10, 720, 823	16, 897, 269
Total	28, 277, 088	40, 992, 584	35, 431, 320	50, 831, 166

MINERAL FUELS

Coal.—Ohio ranked fifth in the Nation in the production of bituminous coal. Although output increased 10 percent in quantity, value increased only 8 percent due to a decrease in average mine value per ton. Strip mines furnished 70 percent of the total production; the remainder came from underground (27 percent) and auger (3 percent) mines. In 1959, 476 mines producing 1,000 tons or more were active—17 less than in 1958. The number of active strip mines decreased from 278 to 258, and underground mines from 165 to 159; auger mines increased from 50 to 59.

Output from strip mines increased to 24,653,000 tons compared with 21,976,000 tons in 1958. Strip mines were active in 25 counties. Harrison County led in output. The average value per ton ($3.61) remained the same as in 1958. Equipment used at Ohio strip mines included 586 power shovels and draglines, 51 carryall scrapers, 507 bulldozers, and 172 power drills. Although the dipper capacities of most of the diesel-powered shovels and draglines averaged less than 3 cubic yards, 13 shovels had capacities over 12 cubic yards.

Underground mines were active in 20 counties, with Belmont and Harrison Counties leading in output and value. The value of underground coal mined dropped to $4.56 from $4.68 per ton in 1958. Less than 1 percent of the underground output was cut by hand or shot from solid; the remainder was cut by machine, 29 percent by continuous miners. Ninety percent of the underground output was mechanically loaded. Although continuous mining machines increased by 1 to 35, their output declined from 2.9 to 2.8 million tons.

Output from auger mines decreased 13 percent compared with 1958; average value dropped to $3.43 from $3.65 per ton. Coal was recovered by auger mining in 16 counties. Jefferson County led in output with six mines producing 132,000 tons.

Twenty-three preparation plants (one less than in 1958) were in operation. Over 15 million tons of coal was cleaned, principally by wet-washing methods. At mines having crushing facilities, 13.3 million tons were crushed. Output of mines having treatment facilities totaled 17.6 million tons. Of this total, 4.7 million tons were treated—2.5 million tons with oil, 1.3 million tons with calcium chloride, 20,000 tons with both calcium chloride and oil, and 944,000 tons with all other materials.

Of the total output, 54 percent was shipped by rail or water, 35 percent by truck, and the remainder by other means, mainly pipeline. Output of coal by captive operations represented 11 percent of the total.

TABLE 8.—Bituminous coal production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	35,825	$135,523	1957	36,862	$146,134
1955	37,870	133,814	1958	32,028	126,241
1956	38,934	148,650	1959	35,112	135,729

Coke and Coal Chemicals.—Ohio ranked second among the coke-producing States (third in 1958). Output of coke increased 37 percent to 8.8 million short tons, valued at $147.9 million. The average value per ton decreased to $16.73 from $17.03 in 1958, which was well below the national average of $17.82. The yield of coke from 12,446,000 tons of carbonized coal was 71.03 percent (69.87 percent in 1958). Of 12.4 million tons of coking coal delivered to Ohio plants, West Virginia supplied over half (54 percent); Pennsylvania, 29 percent; Virginia, 9 percent; and Kentucky, 8 percent. Compared with 1958 coal receipts, Virginia and West Virginia deliveries increased 91 and 49 percent, respectively. Seventy-two percent of the coal received was high-volatile coal, 24 percent low-volatile, and 4 percent medium-volatile. On December 31, 1959, 14 plants operated 2,390 ovens (all slot type), 1 less plant and 125 less ovens than in 1958. Eighty-eight percent of the coke produced was consumed by producing companies, largely in blast furnaces. The balance represented commercial sales to blast furnaces, foundries, other industrial consumers, and for residential heating. Coproducts recovered at coke plants included coke breeze (538,000 tons, of which 47 percent was sold and 47 percent was consumed in the producers' own steam and agglomerating plants), coke-oven gas (125,376 million cubic feet), ammonium sulfate (92,000 tons), ammonium liquor (NH_3 content, 3,600 tons), coke-oven tar (98.6 million gallons), and crude light oil (32.1 million gallons). Products derived from the light oil were benzene (17.3 million gallons), toluene (3.7 million gallons), xylene (1.3 million gallons), and solvent naphtha (600,000 gallons).

Fuel Briquets and Package Fuel.—Consumption of fuel briquets in Ohio totaled 50,000 tons, 13,000 tons less than in 1958. Production of packaged fuel at the State's seven active plants totaled 4,000 tons valued at $89,000—one less plant and 2,000 fewer tons than in 1958. State output was 12 percent of the national total, valued at $1.08 less per ton than the national average of $23.45. Exports of fuel briquets (coal and coke) from the Ohio Customs District, mostly to Canada, increased from 90 tons in 1957 to 892 tons in 1959; none was exported through the district in 1958.

Peat.—Peat was recovered from 11 operations compared with 8 operations in 1958. Although output increased slightly, the value declined 30 percent, mainly because more peat was sold in bulk, which has a lower unit value. Of the total output, 92 percent was sold in bulk, compared with 76 percent in 1958; the remainder was sold in packages. Shipments of peat into the State increased to 27,000 tons from 17,000 tons in 1958. Peat was recovered in six counties and sold mostly for soil improvement. Richland, Stark, and Miami Counties, in decreasing order of output, were the leading peat-producing areas.

Petroleum and Natural Gas.—The State's biggest drilling year was recorded in 1959. A total of 1,133 well completions (including 484 oil, 297 gas, 274 dry holes, and 78 service wells) were made, 84 more than in 1958. Footage for completed wells totaled 2,918,000; the average footage declined to 2,576 from 2,582 in 1958. Thirty-nine wildcat completions (7 oil, 8 gas, and 12 dry) were reported, compared with 23 in 1958. Among the 21 counties with wildcat-well activity, Coshocton County ranked first with 5, followed by Morgan County with 3. Development completions totaled 1,094 (477 oil, 289 gas, 250 dry, and 78 service). Of the development completions, Wayne County ranked first with 149 followed by Coshocton and Holmes Counties with 117 and 112, respectively. Ninety-seven percent of the total well completion was by cable-tool operations compared with the national average of 22 percent.[4] Output of natural gas increased slightly but crude-petroleum production declined. No natural-gas liquids were recovered. Proved reserves, December 31, 1959 (according to American Petroleum Institute and the American Gas Association) were natural gas, 748,766 million cubic feet (14.65 p.s.i.a., at 60° F.); crude petroleum, 74.1 million barrels; natural-gas liquids, 1.6 million barrels. The reserve of crude petroleum was increased 3.3 million barrels; natural-gas liquids and natural-gas reserves decreased. Total capacities at the State's 11 active refineries and cracking plants were 435,000 and 173,000 barrels per day of crude oil and gasoline, respectively. Refineries were at Canton, Cincinnati, Cleveland, Cleves, Lima, Newark, Toledo (4), and Weston.

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[4] Oil and Gas Journal, vol. 58, No. 4, Jan. 25, 1960.

METALS

Aluminum.—Ormet Corp., owned jointly by Olin Mathieson Chemical Corp. and Revere Copper & Brass, Inc., completed the first full year of production at its primary aluminum plant at Omal near Clarington (Monroe County). The fifth and last potline at the $110 million reduction plant began producing in January. Alumina for the plant was produced from Surinam bauxite at the company's Burnside, La., plant and transported in specially designed barges up the Mississippi and Ohio Rivers to the Omal plant. Power was generated at the newly completed electric generating plant across the Ohio River at Cresap, W. Va. Construction was completed at the aluminum rolling mill of Olin Mathieson Chemical Corp. adjacent to the reduction plane at Omal.

Beryllium.—Brush Beryllium Co. at Elmore continued to produce beryllium oxide for ceramics, alloys for industrial and defense uses, and metal for the Atomic Energy Commission (AEC) for nuclear applications. The company also produced beryllium for special applications in aircraft, missiles, and space vehicles. Research on new applications in these fields continued. During the year a record-sized beryllium forging was produced by hot pressing beryllium powder. The company announced plans to expand facilities at its Elmore plant.

Ferroalloys.—Ohio was the leading producer of ferroalloys with a total output of 533,000 tons—41 percent higher than in 1958. Compared with 1958 shipments increased 35 percent in tonnage and 52 percent in value and totaled 547,000 tons valued at $140.7 million. The increase was due primarily to a 91-percent increase in shipments of ferrochrome and chrome briquets and to increased production and higher unit values for most ferroalloys. Fifteen principal classifications of ferroalloys were produced, compared with twelve in 1958. Ferromanganese, silicomanganese, silvery pig iron, ferrosilicon, and ferrochromium and chromium briquets represented 97 percent of the tonnage and 91 percent of the value of all ferroalloys shipped from plants in Ohio.

TABLE 9.—Producers of ferroalloys in 1959

Company	Location	Type of furnace	Ferroalloys produced [1]
Interlake Iron Corp	Beverly	Electric	SiMn, FeSi, FeCr.
Do	Jackson	Blast and electric	Silvery pig iron, FeSi.
Jackson Iron & Steel Co	do	Blast	Silvery pig iron.
Ohio Ferro-Alloys Corp	Brilliant	Electric	FeSi, FeCr.
Do	Philo	do	FeMn, SiMn, FeSi, other miscellaneous ferroalloys.
Do	Powhatan Point	do	FeSi, Si, other miscellaneous ferroalloys.
Union Carbide Metals Co	Marietta	do	FeMn, SiMn, FeSi, FeCr, Spiegeleisen, other miscellaneous ferroalloys.
Do	Ashtabula	do	FeMn, SiMn, FeSi, FeCr.
Vanadium Corp. of America	Vancoram	do	FeCr.
Do	Cambridge	do	FeMn, FeTi, FeV, FeB, FeCb, FeCbTa, other miscellaneous ferroalloys.

[1] Abbreviations used: FeMn, ferromanganese; SiMn, silicomanganese; FeSi, ferrosilicon; FeCr, ferrochromium; FeTi, ferrotitanium; FeB, ferroboron; FeCb, ferrocolumbium; FeV, ferrovanadium; FeCbTa, ferrocolumbium-tantalum; Si, silicon.

Iron and Steel.—Although the industry was idled by a 116-day strike, pig iron production increased 21 percent over 1958 and totaled 11.5 million tons. Types of pig iron produced were basic, Bessemer, malleable, foundry, low-phosphorus, and direct casting. Basic and bessemer pig iron predominated and totaled 8.9 and 1.7 million short tons, respectively. Basic pig iron production increased 30 percent; bessemer output declined 6 percent. A total 7.7 million tons of domestic iron ore and 2.8 million tons of foreign iron ore were consumed in blast furnaces. Consumption of foreign ore in blast furnaces increased 44 percent; domestic ore increased 11 percent. Other metalliferous materials consumed in blast furnaces included 4.2 million tons of domestic sinter, 2,953,000 tons of pellets, 688,000 tons of mill cinder and roll scale, and 57,000 tons of flue dust. In addition, 762,000 tons of home and purchased scrap, 140,000 tons of slag scrap, 755,000 tons of open-hearth and Bessemer slag, 9.1 million tons of coke, and 3.3 million tons of limestone and dolomite were consumed. Scrap and slag production at blast furnaces totaled 176,000 tons and 4.7 million tons, respectively. Recovered materials included 903,000 tons of flue dust.

According to the American Iron and Steel Institute, blast furnace capacity at the State's 22 plants totaled 18,735,000 tons on January 1, 1960, increasing 525,000 tons from January 1, 1959. The total number of stacks remained at 52. Increased capacities were recorded for United States Steel Corp. (central operations) of Youngstown, National Tube Division of Lorain, and American Steel & Wire Division at Cleveland, Republic Steel Corp. plants at Cleveland and Warren, and Armco Steel Corp. at Middletown. Total capacity on January 1, 1960, of the State's 20 steel plants was 28,318,880 short tons, 543,000 tons less than in 1958. Of this total, open-hearth capacity was 22.7 million tons; electric, 3.1 million tons; and Bessemer, 2.6 million tons. The number of open hearths decreased from 179 to 169 and Bessemer furnaces remained at 9. A new electric furnace was placed in operation bringing the total to 36. Copperweld Steel Co. at Warren added an electric furnace to its plant; however, total capacity remained at 660,000 tons.

Lead and Zinc Pigments.—Willard Storage Battery Co. at Cleveland (Cuyahoga County) produced black lead oxide pigments. Zinc pigments (chlorides and sulfates) were manufactured at Cleveland by E. I. du Pont de Nemours & Co. American Zinc Oxide Co. at Columbus (Franklin County) manufactured zinc oxide and leaded zinc oxide pigments.

Titanium.—Mallory-Sharon Metals Corp. and Union Carbide Metals Co., both at Ashtabula, produced titanium sponge by sodium reduction of titanium tetrachloride. Titanium was melted by Republic Steel Corp. at Massilon and Canton and Mallory-Sharon Metals Corp. at Niles. Titanium Metals Corp. of America at Toronto and Mallory-Sharon Metals Corp. at Niles rolled and fabricated titanium metal.

Zirconium.—Mallory-Sharon Metals Corp. produced hafnium-free zirconium sponge by sodium-reduction at Ashtabula and zirconium ingot at its Niles plant. The sodium was obtained from the Ashtabula plant of United States Industrial Chemical Corp. Union Carbide Metals Co. (Ashtabula) continued to make zirconium ferroalloys, and

TABLE 10.—Annual capacity of blast furnaces, January 1, 1960, in short tons
[American Iron and Steel Institute]

Company	Location of plant	Number of stacks	Total annual capacity (short tons)
Louis Berkman Co	Belmont County: Martins Ferry	1	136,800
	Butler County:		
Armco Steel Corp	Middletown	1	854,000
Do	New Miami	2	604,000
	Cuyahoga County:		
American Steel & Wire Division	Cleveland	2	805,000
Jones & Laughlin Steel Corp	do	2	866,000
Republic Steel Corp	do	6	2,708,000
	Jackson County:		
Interlake Iron Corp	Jackson	1	75,000
Jackson Iron & Steel Corp	do	1	95,000
Wheeling Steel Corp	Jefferson County: Steubenville	5	1,708,000
National Tube Division	Lorain County: Lorain	5	2,160,000
Interlake Iron Corp	Lucas County: Toledo	2	551,000
	Mahoning County:		
Youngstown Sheet & Tube Co	Campbell	4	1,452,000
Sharon Steel Corp	Lowellville	1	149,000
Pittsburgh Coke & Chemical Co	Struthers	1	182,500
Republic Steel Corp	Youngstown	5	1,773,000
United States Steel Corp. (central operations)	do	5	1,976,500
Youngstown Sheet & Tube Co	do	2	504,000
Detroit Steel Corp	Scioto County: Portsmouth	2	768,700
	Stark County:		
Republic Steel Corp	Canton	1	266,000
Do	Massillon	1	266,000
	Trumbull County:		
Youngstown Sheet & Tube Co	Hubbard	1	204,000
Republic Steel Corp	Warren	1	630,000

Vanadium Corp. of America made the zirconium-bearing alloy Grainal 79 at Cambridge. Zirconium Corp. of America started to expand its zirconium oxide production facilities at Solon. Research to expand the use of zirconium for its corrosion-resistant properties was continued. The Zirconium Association, with headquarters in Cleveland, was formed by 16 companies (including Mallory-Sharon Metals Corp.), which produced or fabricated the metal.

REVIEW BY COUNTIES

Mineral production (excluding petroleum and natural gas) was reported from all counties except Fulton. Mineral values increased in 74 of the 87 mineral-producing counties. Thirteen counties reported mineral values exceeding $10 million. Leading mineral-producing areas, in decreasing order of value, were Harrison, Belmont, Greene, and Lake Counties. Excluded from the county review section (except Delaware County) were references to sand and gravel production by Government-and-contractor operations, mainly for the State of Ohio Highway Department. Also excluded were details on petroleum and natural-gas operations for which county breakdowns were not available.

Adams.—Limestone was quarried and crushed at Peebles by Davon, Inc., and for use mainly as concrete aggregate and roadstone but also for agstone, cement, coal-mine rock dust, and railroad ballast. Limestone for road construction and maintenance was quarried by Adams County Highway Department.

TABLE 11.—Value of mineral production in Ohio, by counties [1, 2]

County	1958	1959	Minerals produced in 1959 in order of value
Adams	$561,774	$495,609	Stone.
Allen	984,283	862,538	Do.
Ashland	(3)	(3)	Sand and gravel, clay.
Ashtabula	(3)	(3)	Lime, sand and gravel, gem stones.
Athens	2,249,545	2,544,012	Coal, stone, clay, sand and gravel.
Auglaize	(3)	(3)	Sand and gravel, stone.
Belmont	27,440,870	27,650,404	Coal, stone.
Brown	70,994	96,890	Stone, sand and gravel.
Butler	2,156,372	2,951,839	Sand and gravel.
Carroll	2,082,502	1,973,515	Coal, clay, stone, sand and gravel.
Champaign	(3)	310,108	Sand and gravel.
Clark	(3)	(3)	Sand and gravel, lime, stone.
Clermont	(3)	908,575	Sand and gravel.
Clinton	565,680	1,091,162	Stone, sand and gravel.
Columbiana	(3)	(3)	Coal, clay, sand and gravel, stone.
Coshocton	6,232,693	7,868,583	Coal, sand and gravel, stone.
Crawford	(3)	(3)	Stone, sand and gravel.
Cuyahoga	877,892	1,204,653	Sand and gravel, clay, gem stones.
Darke	(3)	(3)	Sand and gravel, clay.
Defiance	------------	(3)	Sand and gravel.
Delaware	(3)	1,828,307	Lime, stone, sand and gravel, clay.
Erie	4,092,210	6,406,165	Stone, cement, sand and gravel.
Fairfield	263,721	456,015	Sand and gravel.
Fayette	782,619	887,841	Stone.
Franklin	8,664,132	9,215,449	Sand and gravel, stone, lime, clay.
Gallia	(3)	(3)	Coal, sand and gravel.
Geauga	(3)	(3)	Sand and gravel, stone.
Greene	(3)	(3)	Cement, sand and gravel.
Guernsey	1,184,867	1,337,057	Coal, stone.
Hamilton	4,201,780	4,935,010	Sand and gravel, stone.
Hancock	(3)	(3)	Stone, clay.
Hardin	(3)	(3)	Stone.
Harrison	30,707,511	33,218,717	Coal, stone, clay.
Henry	(3)	(3)	Sand and gravel, clay.
Highland	(3)	(3)	Stone, sand and gravel, clay.
Hocking	508,489	502,206	Coal, clay, sand and gravel.
Holmes	661,734	1,122,095	Stone, coal, clay, sand and gravel.
Huron	80,025	70,700	Sand and gravel.
Jackson	1,771,306	(3)	Coal, clay, sand and gravel.
Jefferson	14,115,599	14,833,932	Coal, sand and gravel, clay, stone.
Knox	(3)	(3)	Sand and gravel, stone.
Lake	(3)	(3)	Cement, lime, salt, sand and gravel.
Lawrence	8,250,641	10,302,141	Cement, coal, clay, sand and gravel, stone
Licking	612,656	630,780	Sand and gravel, gem stones.
Logan	(3)	(3)	Stone, sand and gravel.
Lorain	(3)	(3)	Stone, sand and gravel, abrasives.
Lucas	(3)	(3)	Cement, stone, sand and gravel, gem stones.
Madison	(3)	(3)	Sand and gravel, stone, clay.
Mahoning	(3)	(3)	Coal, stone, clay, sand and gravel, peat.
Marion	(3)	(3)	Stone, clay, sand and gravel.
Medina	(3)	(3)	Sand and gravel, clay.
Meigs	(3)	(3)	Coal, sand and gravel, salt.
Mercer	(3)	(3)	Stone, sand and gravel.
Miami	1,885,019	(3)	Stone, sand and gravel, peat.
Monroe	57,641	(3)	Sand and gravel, stone.
Montgomery	(3)	4,091,738	Sand and gravel, stone, lime.
Morgan	(3)	(3)	Coal, sand and gravel.
Morrow	88,570	254,465	Sand and gravel.
Muskingum	(3)	(3)	Cement, coal, stone, sand and gravel, clay.
Noble	(3)	(3)	Coal, stone, clay.
Ottawa	7,760,347	8,097,381	Lime, gypsum, stone, coal, gem stones.
Paulding	(3)	(3)	Cement, stone, clay.
Perry	(3)	(3)	Coal, sand and gravel, clay, stone.
Pickaway	(3)	(3)	Sand and gravel.
Pike	(3)	(3)	Sand and gravel, stone.
Portage	3,668,482	4,313,569	Sand and gravel, stone, coal, clay, peat.
Preble	(3)	(3)	Sand and gravel, lime, stone.
Putnam	(3)	442,115	Stone, clay.
Richland	(3)	(3)	Sand and gravel, clay, peat.
Ross	746,268	(3)	Sand and gravel, stone.
Sandusky	14,299,633	17,941,560	Lime, stone, sand and gravel, gem stones.
Scioto	(3)	(3)	Stone, clay, sand and gravel.
Seneca	(3)	(3)	Lime, stone, clay, gem stones.
Shelby	(3)	(3)	Sand and gravel, stone.
Stark	10,418,661	11,857,316	Cement, coal, clay, sand and gravel, stone, peat.
Summit	14,438,002	12,292,033	Salt, lime, sand and gravel, stone, cement.
Trumbull	185,241	225,257	Sand and gravel.

See footnotes at end of tables,

TABLE 11.—Value of mineral production in Ohio, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Tuscarawas	$12,837,309	$14,050,236	Coal, clay, sand and gravel, stone.
Union	(3)	(3)	Stone, sand and gravel.
Van Wert	(3)	(3)	Stone, clay.
Vinton	(3)	(3)	Coal, clay, stone.
Warren	437,066	315,611	Sand and gravel.
Washington	(3)	(3)	Coal, sand and gravel, stone, abrasives, clay.
Wayne	(3)	(3)	Salt, sand and gravel, coal, clay.
Williams	(3)	(3)	Sand and gravel, clay.
Wood	530,402	(3)	Stone, clay, gem stones.
Wyandot	(3)	(3)	Stone, lime, sand and gravel, peat, clay.
Undistributed	158,382,970	188,315,619	
Total	344,856,000	395,901,000	

[1] Fulton County not listed as no production was reported.

[2] Fuels, including natural gas, petroleum, and natural-gas liquids, not listed by counties, as data are not available; included with "Undistributed."

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Allen.—Limestone production from four quarries near Bluffton, Delphos, and Lima (2), totaled 660,000 tons, an increase of 8 percent over 1958. Most of the output was used as roadstone and concrete aggregate and the remainder as railroad ballast and agstone.

Ashland.—Prepared sand and gravel for use in building and paving was produced near Loudonville and Ashland. Unprepared material, comprising 30 percent of the total output, was used principally for road base. The E. Bigelow Co. produced heavy clay products from miscellaneous clay mined from an open pit near New London.

Ashtabula.—Commercial production of sand and gravel used in building and highway construction was reported by companies operating at Conneaut, Kingsville, and Ashtabula. Molding sand was produced near Conneaut. Specimens of strontianite were recovered near Geneva.

Athens.—Output from 12 underground, 1 auger, and 3 strip coal mines totaled 359,000 tons, 5 percent less than in 1958. Coal was cleaned by wet washing at the No. 255 plant of Gem Coal Co. Shamrock Quarries, Inc., and Diamond Stone Quarries, Inc., both near Albany, quarried limestone used exclusively for concrete aggregate and roadstone. Plastic fire clay was mined near Nelsonville and shipped to plants in Hocking County for manufacturing building brick and other heavy clay products. Sand and gravel was produced near Athens and The Plains for use in highway and building construction.

Auglaize.—Sand and gravel, used principally in building and highway construction, was produced principally from pits near Wapakoneta and Lima. National Lime & Stone Co. quarried and crushed limestone at Buckland for use as concrete aggregate and agstone.

Belmont.—The county continued as the second ranking coal-producing area; 6.5 million tons was recovered, compared with 6.2 million tons in 1958. Sixty-six percent of the total output was recovered from underground mines; the remainder came from 26 strip and 8 auger mines. Over 4 million tons of coal (3.7 million in 1958) was cleaned at seven cleaning plants. In addition, 2.6 million tons of coal was crushed and 757,000 tons was treated with calcium chloride or oil.

Limestone used mainly for concrete aggregate and roadstone was produced by George and C. H. McCort (Malaga) and Somerton Crushing Co. (Somerton).

Brown.—Limestone was produced by the county highway department and Howard S. Watson (Georgetown). Output was used mainly for concrete aggregate and roadstone. A small quantity of bank-run gravel was produced near Georgetown.

Butler.—Eleven commercial sand and gravel plants produced 2.5 million tons, making Butler County the fourth largest producer in the State. American Materials Corp. expanded capacity at its North Hamilton plant by installing a large dragline.

Carroll.—Eighteen coal mines (10 strip, 4 underground, and 4 auger) were active, compared with 12 mines in 1958. Output increased to 425,000 tons from 380,000 tons in 1958. Four mines crushed 150,000 tons of coal. Fire clay used for manufacturing refractories, building brick, and other heavy clay products was recovered from pits near Magnolia and Minerva. Miscellaneous clay was produced near Magnolia and used for manufacturing heavy clay products. The Ames limestone plant (Carrollton) of Hanna Coal Co. Division, Consolidation Coal Co., was idle in 1959. However, sales of limestone for concrete aggregate and roadstone were made from stockpiled material. Mineral City Sand Co. produced molding sand.

Champaign.—Most of the sand and gravel came from the Urbana pit of American Aggregates Corp., where a large tonnage of paving material and railroad ballast was produced. Sand and gravel for construction was produced near Springhill.

Clark.—Sand and gravel for building and highway construction and fill was produced at 10 plants. Most of the material was produced in the vicinity of Springfield and New Carlisle. Moores Lime Co. quarried limestone at Durbin for use as aggregate, agstone, blast-furnace flux, filler, and raw material for manufacturing lime and dead-burned dolomite. Lime produced in four shaft kilns and one continuous hydrator was used in construction, agriculture, sewage treatment, water purification, and papermaking.

Clermont.—Two companies at Miamiville and Monterey produced sand and gravel for building and highways.

Clinton.—Melvin Stone Co. quarried limestone near Melvin for use as concrete aggregate, roadstone, agstone, riprap, and flux. The company also produced sand and gravel for building and highway construction at its Sligo plant.

Columbiana.—Although the number of active coal mines decreased to 42 from 62 in 1958, output dropped only 2 percent. There were 26 strip, 9 auger, and 7 underground mines. The county continued to rank second in value of clay produced. Output was reported from eight pits in the eastern part of the county. Fire clay was used primarily for manufacturing fire brick and block and other refractories. Miscellaneous clay was used for building brick, vitrified sewer pipe, floor and wall tile, and other heavy clay products. Iron City Sand & Gravel Corp., operating a dredge at East Liverpool, was the principal sand and gravel producer. Two stationary plants at Leetonia and one at Salem were active during the year. Sandy Beaver

Stone Co. quarried limestone near Hanoverton for use as concrete aggregate and roadstone.

Coshocton.—Coal production (mostly strip mined) totaled 1.7 million tons, a 32-percent increase over 1958. Nineteen mines (9 strip, 8 underground, and 2 auger) were active. Of the total output, 659,000 tons was crushed and 89,000 tons treated. Prepared sand and gravel used in building construction and paving was produced by eight companies. Briar Hill Stone Co. of Glenmont produced sandstone at three quarries in the county. The stone was sawed for architectural applications and dressed for use in steel mills. Variegated Quarries Division, Nicholl Stone Co., also produced sandstone for architectural applications. Output was shipped to a company-owned fabricating plant in Holmes County.

Crawford.—National Lime & Stone Co. produced limestone at its Spore quarry near Bucyrus. Output was crushed and sized for concrete aggregate, roadstone, sinter stone, agstone, and railroad ballast. Limestone also was produced by the Crawford County Highway Department for road construction and maintenance. Galion Gravel Co. (Galion) produced filtration sand as well as sand and gravel for building, paving, and fill.

Cuyahoga.—Output of commercial sand and gravel increased 34 percent over 1958. Miscellaneous clay and shale was produced at seven operations and was used mainly for manufacturing building brick and lightweight aggregate. Limited quantities were used for manufacturing unpainted flower pots. Mineral specimens of selenite crystals were recovered in the county. Cleveland Gypsum Co. (Cleveland) expanded crude perlite shipped from Colorado, Nevada, and New Mexico. Output was used as plaster and concrete aggregate and for soil conditioning.

Darke.—Sand and gravel was recovered at eight localities. American Aggregate Corp. (Fort Jefferson) was the leading producer. Most of the output was used for highway construction. Miscellaneous clay used for manufacturing draintile was mined near Greenville.

Defiance.—Sand and gravel used in building and paving was produced from pits at Hicksville and Defiance.

Delaware.—Limestone output increased to 872,000 tons from 579,000 tons in 1958 and came from quarries near Delaware, Powell, Radnor, and Ostrander. Output was used for concrete aggregate, roadstone, agstone, railroad ballast, and riprap, and for manufacturing lime. Scioto Lime & Stone Co., Inc. (Delaware) produced quicklime and hydrated lime for use in construction, as flux in open-hearth and electric furnaces, bleach in papermills, neutralizer for waste treatment, and as a reagent in water-treatment plants. Most of the lime output was shipped to consumers in Ohio and West Virginia. Unprepared paving gravel was produced under contract for the State of Ohio Highway Department. Building brick was produced from shale by the Delaware Clay Co. (Westerville) and Galena Shale Tile & Brick Co. (Galena).

Erie.—Medusa Portland Cement Co. mined calcareous marl and clay for manufacturing cement (portland and masonry) at its Bay Bridge plant. Gypsum and limestone also were used as cement raw materials. Types of portland cement produced at the plant were Types I–II (general use), Type II (highly-early-strength), and waterproof. Finished cement was shipped to consumers in Ohio, Michigan, and Indiana. County output of limestone increased sharply due to increased demand for stone used as concrete aggregate and roadstone. In addition, limestone was sold for use as riprap, railroad ballast, agstone, stone sand, and as filter stone. Producers were: Wagner Quarries Co. (Sandusky), Castalia Quarries Co. (Castalia), and Sandusky Crushed Stone Co., Inc. (Parkertown).

Fairfield.—Sand and gravel for use in highway and building construction was produced by four operators near Lancaster, and one near Reynoldsburg.

Fayette.—Crushed limestone was produced by Blue Rock, Inc., Fayette Limestone Co., Inc., and Sugar Creek Stone Co., all near Washington Court House. Of the total output, 57 percent was utilized as concrete aggregate and the remainder sold as riprap, agstone, railroad ballast, and for other miscellaneous uses.

Franklin.—Output of 4.5 million tons of sand and gravel made Franklin County the leading producing area in the State. American Aggregates Corp., South Columbus, increased capacity by installing a new dragline in its pit and rebuilding its sand plant. Marble Cliff Quarries Co. (Columbus) crushed limestone for metallurgical uses, railroad ballast, and agstone. Part of the output also was used by the company in manufacturing quicklime and hydrated lime. Shale was recovered from two pits near Blacklick for use in manufacturing building brick and draintile.

Gallia.—Coal output increased 8 percent and came from 26 mines (15 underground, 7 strip, and 4 auger). A limited quantity of coal was cleaned at the Cheshire plant of Peacock Coal Co. by wet washing. Production of sand and gravel during the year included material for construction and paving, as well as molding and blast sand.

Geauga.—Sand and gravel for building and paving was produced by six operators. Industrial sand was prepared near Thompson. Harbison-Walker Refractories Co. produced quartzite near Thompson for use in manufacturing silica brick.

Greene.—The county continued as the leading area in cement manufacture owing to the output of Southwestern Portland Cement Co. and Universal Atlas Cement Division of United States Steel Corp., both near Fairborn. Limestone and clay produced nearby were the chief cement raw materials utilized by the companies. Sand, gypsum, and iron ore also were utilized as raw materials. Types I and II portland cement for general use, high-early-strength, waterproof, and masonry cement were produced. Eleven commercial sand and gravel plants produced aggregate for use in building construction and paving.

Guernsey.—Seven strip and four underground mines produced 250,000 tons of coal—23,000 tons less than in 1958. Crushed dolomite used for roads was produced near New Concord by John Gress Co.

Hamilton.—Commercial sand and gravel output of 3.5 million tons made Hamilton the second ranking sand and gravel-producing county in the State. Output was 12 percent greater than in 1958 and came from 11 commercial operations. Sand and gravel was shipped 77 percent by truck, 21 percent by rail, and 1 percent by water and was used for building, paving, and fill. Agstone (limestone) was produced at the Camp Dennison and Newtown quarries of Ohio Gravel Co.

Hancock.—Limestone used mainly for concrete aggregate, roadstone, and railroad ballast was quarried by National Lime & Stone Co. and Tarbox-McCall Stone Co., both near Findlay, and by Pifer Stone Co. (Williamstown). Hancock Brick & Tile Co. (Findlay) mined miscellaneous clay used in manufacturing heavy clay products.

Hardin.—Herzog Lime & Stone Co. (Forest) and Hardin Quarry Co. (Blanchard) quarried limestone mainly for concrete aggregate, metallurgical purposes, and agstone.

Harrison.—The county continued to rank first among the State's 25 coal-producing areas. Output increased to 7.6 million tons from 6.9 million tons in 1958 and came chiefly from 10 strip mines. Thirty-three percent of the coal came from 7 underground mines; less than 1 percent was produced at 5 auger mines. The average value per ton of coal dropped to $4.32 per ton from $4.43 in 1958. Most of the coal was cleaned at the Georgetown plant of Hanna Coal Co. Division, Consolidation Coal Co., and the Nelms plant of Youghiogheny and Ohio Coal Co. Some of the county coal output was shipped to Jefferson County for cleaning at the Piney Fork No. 1 plant. In addition, a substantial quantity of coal was crushed and treated for dust preventative or antifreezing. Hanna Coal Co. Division, Consolidation Coal Co. (Cadiz) also quarried limestone for use as concrete aggregate, roadstone, and agstone. Farm draintile was produced from miscellaneous shale mined near Bowerstown by Bowerstown Shale Co.

Henry.—Sand and gravel for building and paving was recovered from two pits near Napoleon. Miscellaneous clay used for manufacturing farm draintile was produced by August Honeck & Sons (Malinta) and Napoleon Brick & Tile Work (Napoleon).

Highland.—Highland Stone Division, Davon, Inc. (Hillsboro) and Ohio Asphaltic Limestone Co., Inc. (New Vienna) quarried limestone used exclusively for concrete aggregate, roadstone, and agstone. Four commercial pits yielded sand and gravel for use as concrete aggregate, paving material, and fill. Mowrystown Brick & Tile Co. (Mowrystown) mined miscellaneous clay used for manufacturing building brick and other heavy clay products.

Hocking.—Coal output totaled 59,000 tons and came from 5 underground, 5 strip, and 3 auger mines. General Hocking Brick Co. mined plastic fire clay and miscellaneous shale, used entirely for building brick, from the Mohler pit near Logan. Natco Corp. produced heavy clay products and building brick at the Haydenville plant from plastic fire clay mined nearby and in Athens County. Donahey Bros. and F. H. Brewer, Inc., continued to produce sand and gravel from pits near Logan and Enterprise, respectively.

Holmes.—Limestone for agricultural use was quarried near Berlin by Holmes Clay Division, Holmes Limestone Co. Briar Hill Stone Co. produced sawed architectural stone from four sandstone quarries. Variegated Quarries Division, Nicholl Stone Co., fabricated sawed architectural sandstone quarried in Coshocton County at a mill near

Killbuck. Coal output increased to 95,000 tons from 34,000 tons in 1958 and came from 3 strip mines and 1 underground mine. General Clay Products Co. mined miscellaneous clay and plastic fire clay near Baltic for use in manufacturing building brick. Holmes Clay Division, Holmes Limestone Co., and Belden Brick Co., both near Berlin, mined plastic fire clay used in refractories, building brick, flux filler, and as rotary drilling mud. Sand and gravel used mostly for highway construction and repairs was produced from two pits near Millersburg and one pit near Berlin.

Huron.—Huron Sand & Gravel Co., with a stationary plant at Willard, produced filter sand and sand and gravel for building and paving.

Jackson.—Coal production decreased slightly despite an increase in the number of active mines—20 compared with 15 in 1958. Most of the output came from 12 strip mines. Coal was cleaned by wet washing at the Waterloo plant of Waterloo Coal Co. Fire clay was mined at four pits near Oak Hill and was used chiefly for firebrick and block and other refractory uses. Industrial sand for a wide variety of uses was produced by Pennsylvania Glass Sand Corp. near Jackson. Building sand was produced from the Charles E. Wilson silica pit, also near Jackson.

Jefferson.—Output from 50 coal mines (25 strip, 19 underground, and 6 auger) totaled 3.4 million tons, a slight increase over 1958. Sixty-six percent of the coal was strip mined, 30 percent was mined underground, and 4 percent came from auger mines. County coal as well as coal shipped from Harrison County was cleaned by wet washing at the Piney Fork No. 1 plant of Hanna Coal Co. Division, Consolidation Coal Co. The Jennie coal-cleaning plant of North American Coal Co. (formerly Warner Collieries) also was active. Coal produced by Youghiogheny & Ohio Coal Co. was shipped to the Dorothy cleaning plant (company-owned) in Belmont County.

A dredge in the Ohio River near Stratton recovered sand and gravel. Another dredge in the Ohio near Brilliant recovered building and paving sand. Output of clay (83 percent fire clay, 17 percent miscellaneous clay) came mainly from the eastern section of the county. Most of the fire clay was used in manufacturing vitrified sewer pipe, firebrick and block, and other refractory products. The miscellaneous clay was used for manufacturing vitrified sewer pipe.

Freeport Quarries, Inc. (Steubenville) produced sandstone used for rubble.

Knox.—Commercial sand and gravel for building, paving, and fill was produced at plants near Fredericktown, Mt. Vernon, and Killbuck. The plant of Baughman Sand & Gravel near Mt. Vernon was purchased by Purdy Sand & Gravel Co. Millwood Sand Co., Zanesville, continued to produce sand for use in foundries and in manufacturing glass and ceramic products. Briar Hill Stone Co., Glenmont, opened a new sandstone quarry (No. 35) for producing architectural stone. In addition, the company produced architectural sandstone and stone for metallurgical applications at its No. 16 quarry.

Lake.—Standard Portland Cement Division, Diamond Alkali Co. (Painesville), mined clay and purchased limestone and gypsum for manufacturing portland and masonry cements. Finished cement was shipped to consumers in Ohio and Pennsylvania. The company also recovered brine from nearby wells and produced quicklime for manufacturing chlorine and alkalis. Shaft kilns fired with coke were utilized for producing lime.

The Fairport underground salt mine of Morton Salt Co. near Painesville began production late in the year. Mining was by the room and pillar method. Initial drilling and work on the $6 million project began in 1956. Shafts were sunk to the 2,000-foot level. The reserves were estimated at more than 200 million tons. The deposit extends underneath Lake Erie.

Commercial sand and gravel was produced by six operators. Most of the output was bank-run material for use in road building.

Lawrence.—Alpha Portland Cement Co. (Ironton) mined cement rock (limestone) and sandstone and purchased iron ore for manufacturing portland and masonry cements at its nearby plant. Limestone and shale (mined nearby) and purchased gypsum were used in manufacturing cement at the Superior mill of Marquette Cement Manufacturing Co. The bulk of the finished cement produced in the county was shipped to consumers in Ohio.

Coal output totaled 291,000 tons and was recovered from four strip mines.

Clay production (mostly fire clay) was reported from six operations throughout the county. Output was used chiefly for firebrick and block and other refractories and for manufacturing floor and wall tile.

Wilson Sand & Gravel Co. (Chesapeake) prepared sand and gravel for highway paving at a stationary plant and produced unwashed bank-run gravel for use as base material in highway construction.

Licking.—Ten commercial sand and gravel operations were active, mainly in the vicinity of Newark. Output was used for building, paving, and fill. More than 85 percent of the total was washed and screened. American Aggregates Corp. completed construction of a new sand and gravel plant at Newark. Specimens of agate, flint, jasper, and celestite crystals were recovered by amateur collectors principally near Flint Ridge.

Logan.—Limestone was produced by Northwood Stone & Asphalt Co. at Belle Center; National Lime & Stone Co. at East Liberty; and C. E. Duff & Son, Inc., and Western Ohio Stone Co., both near Huntsville. Eighty-four percent of the county output was used in concrete aggregate and roadstone. Commercial sand and gravel for building, paving, and fill was produced at Bellefontaine, Huntsville, and Quincy.

Lorain.—Cleveland Quarries Co. (Amherst) produced dimension sandstone for architectural and refractory uses and for curbing and flagging. The architectural sandstone produced by the company was used in constructing exteriors of buildings in Rocky River and Kent, Ohio, and in Erie, Pa. The company also crushed and ground sandstone for riprap, stone sand, and miscellaneous uses. Architectural sandstone and abrasive stones (grindstones) were produced near Kipton by Nicholl Stone Co. Portable sandstone crushing plants were operated by Stone and Equipment, Inc., and Ohio Rock Products, Inc., near Amherst and Elyria, respectively. Output was used for concrete aggregate, roadstone, riprap, and as a filler. Production of commercial sand and gravel for building, paving, and fill was continued by two operators, both at Lorain.

Lucas.—Medusa Portland Cement Co. (Toledo) quarried limestone and mined clay for use in manufacturing portland cement at its nearby plant. Sand and gypsum also were used as cement raw material. Finished cement was shipped mainly to consumers in Indiana, Michigan, and Ohio. Limestone also was produced in the county by France Stone Co. (Waterville), Toledo Stone & Glass Sand Co. (Sylvania), and Toledo House of Correction (Whitehouse). Output was used mainly for concrete aggregate and roadstone. Five dredges near Toledo produced sand for building and paving. One hundred pounds of calcite with asphaltum was recovered near Maumee.

Madison.—Building and paving sand and gravel was produced at a stationary plant near West Jefferson. Madison Stone Co., Inc., quarried limestone near Galloway for use in concrete aggregate and as riprap. A limited quantity of miscellaneous clay used for manufacturing farm draintile was produced near London.

Mahoning.—Seventeen strip mines produced 905,000 tons of coal compared with 15 strip mines and 685,000 tons in 1958. Limestone used mainly for flux was quarried near Lowellville by Carbon Limestone Co. The company ranked second in the quarry group of National Safety Competition sponsored by the Federal Bureau of Mines for working 367,000 man-hours in 1959 without a loss-time injury. Fire clay for refractories was recovered from pits near Canfield and Youngstown. Miscellaneous clay used for manufacturing building brick was produced near Alliance. Gurlea Sand & Gravel Co. at Salem produced building and paving sand and gravel. Reed-sedge and humus peats were recovered in the county near Damascus and Beloit, respectively.

Marion.—Limestone used mainly for concrete aggregate and roadstone was produced by National Lime & Stone Co. and J. M. Hamilton & Sons Co., both near Marion, and Tri-County Stone Co. (La Rue). Marion Brick Corp. (Iberia) and La Rue Tile Co. (La Rue) produced miscellaneous clay for manufacturing building brick and heavy clay products, respectively. Sand and gravel was produced at two stationary plants near Prospect. The output was used principally for building but some was consumed in road construction and maintenance.

Medina.—Two plants near Lodi, and one in Westfield Township, produced sand and gravel for building, paving, and fill. About 20 percent of the output was unprepared bank-run material; the remainder was washed and screened. Miscellaneous clay used exclusively for manufacturing building brick was produced near Wadsworth by Wadsworth Brick & Tile Co.

Meigs.—Coal was recovered from 13 mines (8 underground, 3 strip, and 2 auger) and totaled 486,000 tons, a slight increase over the previous year. Eighty-one percent of the county output was strip mined. Tri-State Materials Corp., Pomeroy, and Richard & Sons, Inc., Apple Grove, produced sand and gravel for building, paving, and miscellaneous uses. More than 90 percent of the output was shipped by waterway; the balance by truck. Excelsior Salt Works, Inc., produced evaporated salt in open pans near Pomeroy. Most of the salt was shipped to consumers in Ohio and Kentucky.

Mercer.—Rockford Stone Co. (Rockford) and The John W. Karch Stone Co. (Celina) quarried limestone mainly for concrete aggregate. A small quantity of sand and gravel was produced at unspecified locations for use in road maintenance and sanding.

Miami.—Limestone used principally for metallurgical flux was quarried near Piqua by Armco Steel Corp. Commercial sand and gravel for building and paving was produced at stationary plants near Troy, Ludlow Falls, and Piqua. Skinner's Soil Conditioners recovered reed-sedge and humus peats near New Carlisle.

Monroe.—Sand and gravel produced in the county was mostly bank-run material used for road maintenance and sanding. Limestone for aggregate and roadstone was quarried near Woodsfield.

Montgomery.—With 22 active commercial producers, Montgomery continued to be the third ranking county in output of sand and gravel. Dayton had 17 producers, Englewood 2, and Kettering, Pipp City, and West Carrollton 1 each. The material was processed in 18 stationary and 4 portable plants for use in building, paving, and fill. American Aggregates Corp. increased capacity of its South Dayton plant by erecting additional storage facilities and installing a larger dragline.

Limestone-Dayton Co. and Carey Brothers Stone Co., both near Dayton, and Laura Gravel & Stone Co. (Phillipsburg) produced limestone. Quicklime was recovered at the recently constructed lime recovery plant of the City of Dayton Water Department. Lime was recovered in a rotary kiln from waste sludge and recarbonation of water treated for purification and softening. The plant produced more lime than was required by the city; the surplus was sold to other municipalities for similar utilization. Schumacher Industries, Inc., discontinued the production of expanded perlite at its Dayton plant.

Morgan.—Output of coal increased 20 percent and came chiefly from four strip mines. Coal was cleaned at the Roberts & Schaefer plant of Central Ohio Coal Co. Stockport Sand & Gravel Co., with a stationary plant at Stockport, produced building and paving sand and gravel.

Morrow.—A stationary sand and gravel plant was operated at Chesterville to produce material used mainly in paving and as fill. A minor quality was used in building construction.

Muskingum.—Columbia Cement Corp. produced limestone and shale for manufacturing cement at its East Fultonham plant. Gypsum, mill scale, and pyrite cinders also were used for cement raw materials. The bulk of the finished cement output was shipped to consumers in Ohio and West Virginia. Limestone also was produced by Sidwell Brothers (South Zanesville) and Chesterhill Stone Co. (East Fultonham).

Output of coal (mostly strip mined) increased 16 percent. There were 16 coal mines (9 underground, 6 strip, and 1 auger) active during the year. Sand and gravel produced at stationary plants was used principally for building and paving. Some of the output was sold for use in cement production and the manufacture of mineral wool. Miscellaneous clay for building brick and refractory mortar was mined near Frazeysburg and Zanesville, respectively. Fire clay and stoneware clay were mined near Dresden and Roseville.

Noble.—Coal output from 9 strip and 2 auger mines totaled 1.4 millions tons, a 54-percent increase over 1958. Coal was cleaned at the Cumberland plant of Central Ohio Coal Co. James Merry Stone Co. (Caldwell) and Herman Zerger, Jr. (Woodsfield) quarried limestone mainly for concrete aggregate. The Brookfield limestone quarry of Yerian Bros. did not operate in 1959. Ava Brick Co. (Ava) mined miscellaneous shale for manufacturing face brick.

Ottawa.—Chemstone Corp. (Marblehead) quarried limestone principally for metallurgical flux and concrete aggregate. U.S. Gypsum Co. at Genoa quarried limestone for manufacturing lime and for use as concrete aggregate and roadstone. The lime (mainly hydrated) was used for construction, agricultural, chemical, and industrial purposes. The company utilized shaft and rotary kilns and batch hydrators. Bituminous coal and natural gas were used as fuel. Shipments of lime from the plant were made to consumers in 45 States. Dolomite was quarried near Clay Center by Basic, Inc., for use as concrete aggregate, agstone, and for manufacturing dead-burned dolomite.

Crude gypsum was mined and calcined for manufacturing finished building materials by Celotex Corp. (Port Clinton) and U.S. Gypsum Co. (Gypsum). During the year 200 pounds of calcite, 100 pounds of celestite, and 50 pounds of fluorite were recovered in the county near Clay Center.

Paulding.—General Portland Cement Co. (formerly Consolidated Cement Corp.) mined limestone and clay near Paulding and produced portland and masonry cements. Finished cement was shipped to consumers mainly in Indiana, Michigan, and Ohio. Gypsum and sand also were used as cement raw materials. The France Co. (Paulding) and Auglaize Stone Co. (Oakwood) also quarried limestone principally for aggregate. Miscellaneous clay was produced by Haviland Clay Works Co. at Haviland, and Baughman Tile Co., and Dangler Draintile Co., both near Paulding. Output was used exclusively for manufacturing farm draintile.

Perry.—Output of coal (mostly strip mined) decreased slightly from 1958; 12 strip, 8 underground and 2 auger mines were active. Coal was cleaned at 3 plants—1 less than in 1958. Central Silica Co. (Glenford) produced crushed and ground silica sand for foundry, glass, and ceramic uses. Clay (60 percent miscellaneous clay and 40 percent fire clay) was recovered from 10 operations. Output was used mainly for building brick, vitrified sewer pipe, glazed structural tile, roofing tile, other heavy clay products, and lightweight aggregate. Pits were near Junction City, Gore, Logan, New Lexington, Saltillo, Somerset, and Shawnee. Beiter Stone Co. (Rushville) quarried limestone for aggregate.

Pickaway.—Sturm and Dillard Co., Circleville, produced sand and gravel for paving and gravel for railroad ballast.

Pike.—Producers at Beaver and Waverly mined and processed sand and gravel for refractories in the metallurgical field, as well as for molding and glass sand. Standard Slag Co. produced building sand and gravel at Sargents. Ralph Rogers & Co. of Ohio, Inc., produced limestone for aggregate and agricultural purposes near Latham. Harbison-Walker Refractories Co. at Beaver and Cambria Clay Products

Co. at the Big Rock quarry near Jackson quarried quartzite for manufacturing silica brick.

Portage.—Portage County, with an output of 1.8 million tons from 20 plants, continued to be one of the leading sand and gravel areas in the State. Most of the output was washed, screened, or otherwise prepared. Sand and gravel for building, paving, and fill was produced at 15 stationary and 3 portable plants, with Mantua and Ravenna the principal centers. Special industrial sands for a wide variety of uses were prepared by three producers, one each at Aurora, Garrettsville, and Brady Lake. Deerfield Limestone Co. (Deerfield) produced limestone for aggregate. Harbison-Walker Refractories Co. and General Refractories Co. quarried quartzite for manufacturing silica brick near Nelson and Warren, respectively. Kaiser Refractories & Chemicals Division, Kaiser Aluminum and Chemical Corp. (formerly Niles Fire Brick Division, Mexico Refractories Co.) produced quartz for manufacturing silica brick near Garrettsville.

Output of coal from two strip mines increased slightly. Peterson Coal Co. cleaned coal from its Atwater mine by wet washing. Vitrified sewer pipe was produced from miscellaneous clay mined near Palmyra. Moss peat was recovered from bogs near Ravenna by Portage Peat and Green Oaks Peat Moss Co.

Preble.—Four operators produced sand and gravel for paving, building construction, and railroad ballast. Pits were at West Alexandria and Camden. Marble Cliff Quarries Co. quarried limestone and produced quicklime and hydrated lime at Lewisburg.

Putnam.—Limestone was produced in the county at quarries near Columbus Grove, Ottawa, and in Blanchard Township. Miscellaneous clay used exclusively for draintile was produced by Etter Tile and Coal Co. (Dupont), Glandorf Tile Co. (Glandorf), and Miller Bros. Clay Works (Ottoville).

Richland.—Sand and gravel for building and highway construction was produced at plants near Bellville, Lexington, and Killbuck. Ohio Brick and Supply Co. and Richland Shale Brick Co., both near Mansfield, produced shale for building brick. Peat was recovered from bogs near Ganges and Shiloh.

Ross.—Commercial sand and gravel was produced by four operators, two at Chillicothe, and one each at Richmondale and Bainbridge. Output was used for building and highway construction, fill, and railroad ballast. A limited quantity of limestone for aggregate was quarried near Bainbridge by Paint Valley Sand & Gravel Co.

Sandusky.—The county continued to lead in tonnage and value of limestone and lime. Limestone output totaled 3.4 million tons, a 19-percent increase over 1958, of which 58 percent was consumed in manufacturing lime and dead-burned dolomite, 18 percent for concrete aggregate, 10 percent for metallurgical flux, and the remainder for agstone, filler, glass manufacturing, and other uses. Ten limestone quarries and eight lime plants were active in the county. Lime production totaled 929,000 tons valued at $15.5 million, 130,000 tons more than was produced in 1958. Of the total, 55 percent was used for refractories; the remainder was consumed for construction (31 percent), chemical and industrial uses (13 percent), and agricultural purposes (1 percent). The principal lime plants were located near

Gibsonburg, Millersville, and Woodville. Home Sand and Coal Co., Fremont, produced a quantity of building sand. Sphalerite and galena specimens were collected near Gibsonburg by amateur collectors.

Scioto.—Waller Bros. Stone Co. and Taylor Stone Co., both near McDermott, quarried sandstone mainly for refractory furnace linings and architectural purposes. Fire clay for firebrick and block was produced near Wheelersburg and Minford. A small quantity of gravel for building was produced during the year.

Seneca.—Basic, Inc., at Maple Grove quarried dolomite used in manufacturing lime (dead-burned dolomite) at its nearby plant and also for agstone, concrete aggregate, and metallurgical flux. The dead-burned dolomite was produced in rotary kilns with bituminous coal as the major fuel. Output was shipped to consumers in 24 States and 3 foreign countries. The France Co. quarried limestone near Bloomville. Clay for draintile was produced by the J. A. Miller Tile Co. (Bascom) and St. Stephen Tile Co. (St. Stephen). A limited quantity of barite specimens was recovered near Bettsville.

Shelby.—Sidney Sand and Gravel Co. produced sand and gravel for paving at its pit near Sidney. Two other sand and gravel producers were active during the year. Miami River Quarries (Sidney) produced limestone mainly for aggregate.

Stark.—Diamond Portland Cement Co. (Middle Branch) mined limestone and shale and purchased gypsum for manufacturing portland and masonry cements. The cement was consumed mostly in Ohio but small quantities were shipped to Pennsylvania and West Virginia, mostly in bulk. Limestone also was mined for aggregate, riprap, and agstone at Hartville by East Ohio Limestone Co. Output of coal increased to 602,000 tons from 548,000 tons in 1958 and came from 1 underground and 15 strip mines.

The county continued to rank second in clay production. Fourteen operations were active compared with 12 in 1958, producing mostly fire clay (66 percent). Output was used mainly in manufacturing building brick, structural tile, floor and wall tile, and refractories. Production totaling more than 1.4 million tons made Stark County one of the leading sand and gravel producing areas in the State. Of the 17 plants in operation, 15 produced building and paving material and 2 produced sands for filtration and molding. Peat (moss and humus) was recovered from bogs near Canton by Lantz Peat Moss, Inc., Sanders Peat Moss Co., and Lab Nursery and Peat Moss.

Summit.—Evaporated salt and brine was recovered from wells at Akron by Diamond Crystal Salt Co. Evaporated salt was produced in both open and vacuum pans; some was marketed in pressed block form. Columbia-Southern Chemical Co. at Barberton produced evaporated salt and brine, limestone, lime, and portland cement. The evaporated salt was utilized in chemical and various other applications; the brine was used exclusively for manufacturing soda ash and chlorine. Most of the evaporated salt was consumed in Ohio, but some was shipped to neighboring States. Limestone from a nearby underground mine was used for producing quicklime and portland cement. Late in 1959, the newly constructed cement plant was placed in operation for the production of general-use portland cement. Limestone from the mine also was sold for use as aggregate and agstone. The quicklime was used as reagent for manufacturing alkalies. Purchased clay and gypsum also were used as cement raw materials. The company also quarried sandstone in Norton Township for use as aggregate and in manufacturing glass.

Output of sand and gravel by 11 active producers was 33 percent higher than in 1958. Most of the output was washed and screened for building and highway construction. Clay was recovered from three pits, two near Mogadore and one near Greentown. Output was used for manufacturing building brick, vitrified sewer pipe, and other heavy clay products. J. P. Loomis Concrete Supply Co. expanded perlite at Akron from crude material shipped from Colorado. Output was used as a plaster and concrete aggregate.

Trumbull.—Kinsman Sand and Gravel Co. produced prepared building, paving, and fill material from its pit at Kinsman.

Tuscarawas.—Fifty-eight coal mines (31 strip, 20 underground, and 7 auger) were active and produced 2.6 million tons of coal. Output (mainly strip mined) increased 4 percent compared with 1958. Columbia-Southern Chemical Corp. cleaned coal from its Midvale mine by diaphragm jigs and air tables.

The county continued to lead in quantity and value of clay. Fire and miscellaneous clays were produced at 28 mines. Fire clay comprised 73 percent of the clay produced and was used for heavy clay products, refractories, and floor and wall tile. Miscellaneous clay was used mainly for manufacturing heavy clay products, primarily building brick. Of the 28 mines, 22 were open pit, 4 were underground, and 2 were combinations of open pit and underground. Sand and gravel for construction was produced at five plants. Unground furnace, filtration, and engine sand was produced at plants near Dundee and Gnadenhutten. Limestone Aggregates, Inc. (Strasburg) produced limestone for concrete aggregate. Architectural sandstone was produced near Dundee by Yoder Stone Co.

Union.—Limestone was produced by Union Limestone, Inc. (Ostrander) and L. G. Rockhold & Sons (York Center). A small quantity of gravel was produced for use on roads at unspecified locations.

Van Wert.—Union Quarries Co. (Van Wert) and Delphos Quarries Co. (Delphos) produced limestone mainly for concrete aggregate and roadstone. Delphos Clay Works Co. (Delphos) and Weck Tile Plant (Van Wert) produced farm draintile from miscellaneous clay.

Vinton.—Output from the county's eight underground and six strip coal mines totaled 270,000 tons, a 28-percent increase over 1958. Coal was cleaned by jigs at the Econocoal plant of Benedict, Inc. McArthur Brick Co. manufactured building brick from plastic fire clay and shale mined near McArthur. Hope Fire Clay Co. produced firebrick and block from fire clay mined near Zaleski. Limestone used for concrete aggregate and agricultural purposes was produced by McArthur Stone & Coal Co. near McArthur.

Warren.—Gravel pits were operated near Warren, South Lebanon, Waynesville, Loveland, and Morrow to produce sand and gravel for building, paving, and fill.

Washington.—Coal production increased to 298,000 tons from 160,000 tons in 1958; four strip and two auger mines were active. Sand and gravel for building and highway maintenance and construction was produced near Marietta, Waterford, and Coolville. Chesterhill Stone Co. quarried limestone for aggregate at its No. 4 plant near Waterford. Abrasive stone (grindstone) was produced by Constitution Stone Co. (Constitution) and Hall Grindstone Co. (Marietta). A limited quantity of fire clay was produced near Marietta.

Wayne.—Evaporated salt was recovered by open and vacuum pans at Rittman by Morton Salt Co.; some was marketed as pressed blocks. Sand and gravel was produced near Marshallville, Wooster, and Rittman for building, paving, and filtration. Output of coal from two strip mines decreased slightly. Medal Brick and Tile Co. manufactured building brick from miscellaneous clay mined near Wooster. Orrville Tile Co. (Orrville) produced draintile from miscellaneous clay.

Williams.—Sand and gravel production by four companies was consumed in building and highway construction. Most of the output was washed and screened. Draintile was produced from miscellaneous clay near Stryker by the Stryker Draintile Co.

Wood.—Limestone was produced at five quarries mainly for concrete aggregate and roadstone. Producers were: Pugh Quarry Co. (Custar), Wood County Stone & Construction Co. (Bowling Green), O. F. Brough (West Millgrove), and France Stone Co. with quarries at North Baltimore and Luckey. Perrysburg Brick and Tile Co. (Perrysburg) produced miscellaneous clay for manufacturing building brick and draintile. One hundred pounds of marcasite was recovered near Custar.

Wyandot.—National Lime & Stone Co. at Carey quarried limestone for use in its nearby lime plant and for concrete aggregate, roadstone, metallurgical flux, railroad ballast, glass, agstone, and other uses. The lime was used mainly for glass manufacturing. Shipments were made primarily to consumers in Indiana, Pennsylvania, West Virginia, Illinois, Ohio, and New Jersey. Lime also was used for sewage treatment, insecticides, construction, and agricultural purposes. J. L. Foucht (Upper Sandusky) produced limestone for concrete aggregate and agstone. Commercial sand and gravel was produced for building, paving, and filtration uses. Plants were at Findlay and Upper Sandusky. Reed-sedge peat was recovered from a bog near Carey by The Humus Co. The Claycraft Co. (Upper Sandusky) produced building brick from shale.

The Mineral Industry of Oklahoma

This chapter has been prepared under a cooperative agreement for the collection of mineral data except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Oklahoma Geological Survey.

By Peter Grandone [1] and William E. Ham [2]

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PRODUCTION of 15 minerals and 5 mineral fuels was reported in 1959 from 76 of the 77 counties in Oklahoma. Total value ($752 million) of these minerals was $10 million less than in 1958. Compared with other States in 1959, Oklahoma ranked fourth as a producer of natural gas, natural-gas liquids, and crude petroleum. Large quantities of cement, coal, gypsum, sand and gravel, and stone also were produced, but outputs of lead and zinc declined sharply.

TABLE 1.—Mineral production in Oklahoma [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays [2]	576	$579	966	$970
Coal	1,629	10,858	1,525	10,272
Helium .... thousand cubic feet	----------	----------	98,749	1,619
Lead (recoverable content of ores, etc.) .... short tons	3,692	864	601	138
Natural gas .... million cubic feet	696,504	70,347	[3] 701,500	[3] 72,300
Natural-gas liquids:				
Natural gasoline and cycle products .... thousand gallons	440,798	26,029	448,353	29,443
LP-gases .... do	657,114	25,822	675,869	27,070
Petroleum (crude) .... thousand 42-gallon barrels	200,699	594,069	[3] 196,487	[3] 573,742
Salt (common)	4	41	(4)	(4)
Sand and gravel	7,232	5,859	6,002	5,927
Stone	10,794	12,232	12,683	14,980
Zinc (recoverable content of ores, etc.) .... short tons	5,267	1,074	1,049	241
Value of items that cannot be disclosed: Asphalt (native), bentonite, cement, gem stones (1959), gypsum, lime, pumice, tripoli, and values indicated by footnote 4	----------	16,022	----------	18,156
Total Oklahoma [5]	----------	[6] 761,936	----------	751,907

[1] Production as measured by mine shipments or mine sales (including consumption by producers).
[2] Excludes bentonite, value of which is included with "Value of items that cannot be disclosed."
[3] Preliminary figure.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Total adjusted to avoid duplication in values of clays and stone.
[6] Revised figure.

The value of the mineral fuels—petroleum, natural gas, natural-gas liquids, helium, and coal—represented 95 percent of the total value of mineral production. Metals and nonmetals furnished the remainder of the total value. Petroleum and natural gas were produced together or individually in 69 of 77 counties, nonmetals in 70 counties, and metals (lead and zinc) in Ottawa County only. Oil and natural gas were produced in a wide belt extending from the northeastern part of the State to the southwestern and northwestern parts; nonmetal mining was widely distributed over the northeast, north-central, and central regions, and in the Arbuckle and Wichita Mountain areas of the southern part. Helium was recovered for the first time in the State by the new Government plant in Cimarron County.

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Employment and Injuries.—*Employment and Wages.*—Total employment of 48,300 in the Oklahoma mineral industries was slightly less than in 1958. The wages in 1959 for the mineral industries totaled $267.7 million—approximately 2 percent more than in 1958.

Accidents.—Accidents reported in smelters and in metal and nonmetal mining consisted of 174 nonfatal injuries, 2 classified as permanent-partial and the remainder as temporary. In coal mines (14 strip, 9 underground) that produced 1,000 tons or more each, there were 1 fatal and approximately 145 nonfatal injuries. In quarries and mills there were 2 fatal, 3 permanent-partial and 83 temporary injuries. The two fatalities resulted from burns in a cement plant.

TABLE 2.—Employment in mineral industries,[1] in thousands

	1950–54 (average)	1955	1956	1957	1958	1959
Oil and gas drilling and production	42.58	48.4	49.4	48.8	45.8	45.4
Coal mining	1.62	1.3	1.1	1.1	.9	.9
Other mining	2.46	2.3	2.4	1.9	1.8	2.0
Total	46.66	52.0	52.9	51.8	48.5	48.3

[1] Oklahoma Employment Security Commission, Handbook of Employment Statistics of Oklahoma, 1939–59.

Consumption and Markets.—Oklahoma mineral industries processed a significant part of their output into finished and semifinished products for in-State consumption and out-of-State shipments. These industries included oil refineries and natural gasoline and cycle plants stripping natural gas of condensable liquids; a helium-extraction plant; zinc smelters reducing zinc concentrate mined partly in Oklahoma; brick, tile, pottery, glass, and cement plants using clays, shales, silica sands, and limestone of Oklahoma; and producers of building materials made of Oklahoma gypsum. Large quantities of petroleum and natural gas continued to be transmitted by pipelines to industrial sections of the Eastern and North Central States. Ammonia was produced from natural gas, carbon black from petroleum distillates, and high-energy fuel from petroleum hydrocarbons reacted with sodium and boric acid.

Demand for Oklahoma crude petroleum declined gradually during the year and, although it regained some strength at yearend, the total was about 6 million barrels less than in 1958. Production, under State regulatory control, was kept in close balance with demand and stocks.

The metals industry, beset with continued low metal prices, underwent drastic curtailments, and all mines remained closed during 1959. The Eagle-Picher Co. processed only lead and zinc slimes at its Central mill near Commerce, Okla.; its smelter at Henryetta was cut back from a 10-furnace block to a 6-furnace-block operation in April, and then returned to an 8-furnace-block operation in July. Depressed zinc markets and a Nationwide steel strike also forced the State's other two smelters to curtail operations. Blackwell smelter cut its yearly production rate of slab zinc by 4,000 tons, effective July 1.

Total construction (residential, nonresidential, and public works) established a record State volume by gaining about 19 percent. Despite this overall gain, public-works construction fell off appreciably as shortages developed in highway funds and in steel. Demand for stone, cement, and gypsum increased; demand for sand decreased. Output of lime, used primarily as a chemical by the Pryor industries and by municipal water-treating works, declined.

Trends and Developments.—Recoverable petroleum reserves underwent another slight reduction in 1959, but the outlook remained promising, and gas reserves continued to gain. Widespread drilling accounted for another successful oil- and gas-discovery year, as 190 out of 827 exploratory wells proved productive. In new discoveries, Beaver County led with 37; Texas County had 23, and McClain County 11. Significant gas discoveries were made in two widely separated geologic basins. In the prolific Anadarko basin of western Oklahoma, two test wells established the first gas production from Hunton limestone at depths of about 15,000 feet. One of these wells, Magnolia Petroleum Co.'s No. 1 Miller, was second deepest in the State and the first producer in Custer County. Thus, the basin, with five productive formations, emerged as a huge multipay gas and condensate reserve. Its future was enhanced by full-scale development of marketing and transportation facilities. In the Arkoma basin, four gas discoveries aroused new drilling interest in the old eastern gas area of Haskell, Pittsburg, and Latimer Counties.

At least six companies built pipelines into the Panhandle area, yet more facilities will be required to take care of production. Elsewhere in the State, Cosden Petroleum Co. built a 47-mile, 6-inch products pipeline from Wichita Falls, Tex., to Duncan, Okla., where it connected with existing lines to move fuels to Eastern markets. Sunray Mid-Continent Pipe Line Co. built a line to carry crude oil from Alfalfa and Grant Counties to its refineries at Tulsa and Duncan.

Activity in secondary recovery of oil by waterflooding, formerly concentrated in northeastern Oklahoma, was extended to south-central Oklahoma, where, in Garvin County, Cities Service Oil Co. unitized the largest acreage block in the State for waterflooding—the 35,000-acre Northeast Purdy unit. Development of this unit cost $15 million to recover an additional 85 million barrels of oil.

In refining petroleum, the trend toward converted capacity for upgrading motor fuels was nearing its goal. Some activity in this competitive race was shown by installation of alkylation and isomerization units at the West Tulsa refinery of The Texas Co.

In the natural gasoline industry, three new plants were put in operation. Near Purcell, McClain County, Sunray Mid-Continent Oil Co. started operating its $1 million plant to recover 32,000 gallons of liquids daily; near Stroud, Lincoln County, Kerr-McGee Oil Industries, Inc., started operating its Laffoon plant No. 16 to recover

20,000 gallons of liquids daily; and near Blackwell, Kay County, Cities Service Oil Co. was increasing the capacity of its Ambrose plant.

Sun Oil Co. completed a $3.5 million natural gasoline plant at Laverne, Harper County. The plant had the capacity to process 100 million cubic feet of gas daily from the big Laverne gasfield for transmission by pipeline to Detroit and Milwaukee. Natural-gas liquids extracted at the Sun plant were being carried by a new 45-mile pipeline, which was opened August 1 by Wheat Belt Pipe Line Co., to a terminal at Harper Ranch Station in Clark County, Kans. This line, which connected with the Jayhawk Pipe Line at Harper Station, also handled condensate and crude oil from other fields in northwestern Oklahoma.

Closely related to the refining industry was the growing petrochemical industry in the State. At a Pryor plant, annual capacity for ammonia recovery from natural gas was about 70,000 tons. Installations at two refineries at Ponca City and Duncan were producing benzene, toluene, xylene, and propylene hydrocarbons. At Ponca City, Continental Oil Co.'s annual capacity for recovery of all grades of furnace black from refinery distillates was 75 million pounds.

Callery Chemical Co.'s $38 million high-energy fuel plant, opened November 1, 1958, at Muskogee, had its production contract terminated in August 1959 by the Defense Department. However, in December 1959 the U.S. Air Force announced plans to resume production at reduced capacity.

The Nation's shortage of helium ended in August when the Department of the Interior put onstream its new $12 million helium-recovery plant at Keyes, Cimarron County. The plant boosted national annual output of inert, lightweight gas by 290 million cubic feet. Processing Keyes natural gas, supplied by Colorado Interstate Gas Co., contributed significantly to the helium conservation program, because this supply, containing about 2 percent helium, formerly went directly to fuel markets, and the helium was lost.

The cement industry of Oklahoma underwent change and growth in 1959 to keep pace with construction demands. Ideal Cement Co., which started operating its new $20 million plant at Ada in 1958, put its older Ada plant on a standby basis and released 182 employees. Annual capacity of the new plant was 3 million barrels of cement.

Dewey Portland Cement Co. was constructing a new $12 million cement plant on a 1,500-acre tract 4 miles east of Tulsa. The new plant had an initial annual capacity of 1.25 million barrels of cement and was expected to employ approximately 250 persons; its primary market would be the Tulsa area. Power and fuel contracts for the plant called for 25 million kilowatt-hours yearly of electricity and 1.5 billion cubic feet of gas yearly for the first kiln. When the three kilns are completed, 4.5 billion cubic feet of gas will be consumed annually.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma continued to lead in domestic production of crude petroleum and natural gas and to furnish the major supply of refined petroleum products. A substantial quantity of low-ash bituminous coal also was produced.

Coal.—Coal production in Oklahoma declined 6 percent. The decline, however, was not attributed to the extended steel strike in 1959, because Lone Star Steel Co.'s Daingerfield plant (a producer and consumer of Oklahoma coal) operated throughout the year. Coal was mined by 18 operators in 9 counties. Rogers, Haskell, Le Flore, Pittsburg, and Sequoyah Counties were the five leaders, each reporting over $1 million in value. Of the 1.5 million short tons reported, 10 operators produced 77 percent from 14 strip mines; 8 operators produced the remainder from 9 underground mines.

In a report from the laboratories of Curtis-Wright Corp. to the Oklahoma Department of Commerce and Industry, tests on samples of Henryetta coal showed that it was suitable as a binder material for road and runway construction. This new use could stop the decline of the demand for Oklahoma coal.

The Blackstone Mine of Ben Hur Co., the only coal mine left in the Henryetta area, resumed operations September 1. The mine shut down March 1, idling about 125 workers.

TABLE 3.—Coal production

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	2,236	$13,124	1957	2,195	$14,165
1955	2,164	12,668	1958	1,629	10,858
1956	2,007	12,341	1959	1,525	10,272

Helium.—The Federal Bureau of Mines operated a new helium plant at Keyes beginning August 1959 and extracted 119.3 million cubic feet of helium from natural gas. About 16.5 million cubic feet of this volume was injected for conservation in the Government-owned Cliffside gasfield in Texas. Helium shipments from the plant totaled 98.7 million cubic feet valued at $1,618,943.

Natural Gas.—Oklahoma continued to rank fourth in the Nation in marketed production of natural gas. Production was reported from 65 counties, of which Texas, Garvin, Beaver, Grady, and Stephens Counties led in the order named. The industry pressed its search for more reserves by completing 392 gas wells of 5,359 wells of all types, as reported by The Oil and Gas Journal. Exploratory drilling alone led to 73 gas discoveries from 827 exploratory tests. Most promising results were in the Anadarko basin (northwestern area) and the Arkoma basin (old eastern gas area). In the Anadarko basin, first gas production from the deep Hunton limestone was discovered at two points: Magnolia Petroleum Co.'s No. 1 Miller in Custer County and Sinclair Oil & Gas Co.'s No. 1 Spafford in Major County. Magnolia's test well, second deepest (14,818 feet) in the State, also opened first commercial production in Custer County. These major gas strikes spurred the drilling campaign in the multipay basin to increase State gas reserves. At the western end of the Arkoma basin, two gas discoveries in Haskell, one in Latimer, and one in Pittsburg Counties added new significance to the State's eastern gas province. All production was from basal Pennsylvania sands except the Latimer County well, which was completed in the Ordovician Viola limestone.

TABLE 4.—Marketed production of natural gas [1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1950–54 (average)	558, 292	$33, 330	1957	719, 794	$59, 743
1955	614, 976	45, 508	1958	696, 504	70, 347
1956	678, 603	54, 288	1959 [2]	701, 500	72, 300

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.
[2] Preliminary figures.

TABLE 5.—Estimated proved recoverable reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1958	Changes in proved reserves, due to extensions and new discoveries in 1959	Proved reserves, Dec. 31, 1959 (production deducted)	Change from 1958, percent
Crude oil .... thousand barrels..	1, 898, 128	160, 067	1, 864, 749	−2
Natural-gas liquids [2] .... do....	357, 507	38, 381	367, 569	+3
Natural gas .... million cubic feet..	15, 206, 769	2, 389, 523	16, 651, 292	+9

[1] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 14, Dec. 31, 1959, pp. 9, 10, 19.
[2] Includes condensate, natural gasoline, and LP-gases.

As reported by The Oil and Gas Journal, the natural gas industry in 1959 had five gas-storage fields in five Oklahoma counties. These underground storages had a combined capacity of 99.9 billion cubic feet of working-gas volume (above minimum working pressure) and 83.5 billion cubic feet of cushion-gas volume (below minimum working pressure). The available storage capacity permitted continuous production and conservation of casinghead gas from oil wells during periods of low demand for gas.

Natural-Gas Liquids.—Recovery of natural-gas liquids by 67 natural gasoline plants and 3 cycling plants reached a new record of 1,124 million gallons—a 2-percent gain over recovery in 1958. However, most of this gain was in LP-gases (propane and butane) because of increased processing of commercial gas from the prolific gasfields of the Panhandle area and because of increased separation of LP-gases from plant liquids to meet growing demand. Natural gasoline and cycle products furnished 40 percent of the quantity and 52 percent of the value; LP-gases furnished the remainder. Consumption of LP-gases again increased, not only for domestic heating fuels but also for production of petrochemicals, particularly polyethylene.

Underground storage capacity for LP-gases at four sites in Oklahoma totaled 330,000 barrels—30,000 more than in 1958. These sites were abandoned oil wells in Pontotoc County, two salt layers in

Beckham and Beaver Counties, and a shale mining shaft in Seminole County.

TABLE 6.—Natural-gas liquids produced

(Thousand gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	410,071	$26,187	373,405	$12,662	783,476	$38,849
1955	504,692	28,770	512,320	14,297	1,017,012	43,067
1956	489,963	26,543	579,101	23,427	1,069,064	49,970
1957	460,644	25,329	587,140	21,824	1,047,784	47,153
1958	440,798	26,029	657,114	25,822	1,097,912	51,851
1959 [1]	448,353	29,443	675,869	27,070	1,124,222	56,513

[1] Preliminary figures.

Petroleum.—Oklahoma remained fourth largest producer of petroleum in the Nation. The State regulatory body, under the Interstate Oil Compact, reduced the allowable production of 560,000 barrels per day during the first half of the year to 525,000 barrels after July, with no further change. The cut at midyear was to bring production to balance with demand and to reduce the growing stocks of Oklahoma crude oil. Petroleum from approximately 75,630 wells was reported from 63 counties; the leading five producers were Osage, Stephens, Garvin, Carter, and Creek Counties. About 45 percent of production came from nonallocated fields, which included stripper fields and secondary-recovery projects. According to a survey completed May 10, 1960, by the Interstate Compact Commission, Oklahoma, as of January 1, 1959, had 62,905 stripper wells (a well that averages less than 10 barrels of oil daily) which produced 86 million barrels of oil in 1958. Total oil reserve of these wells was 1,384 million barrels, or 73 percent of the overall proved oil reserve in Oklahoma as of January 1, 1959.

The average price per barrel of Oklahoma petroleum at the wells was $2.92, compared with $2.96 in 1958.

The search for more oil led to the drilling of 827 test wells, which again made Oklahoma the third major test-well driller in the Nation. These 827 test wells (117 oil-productive and 73 gas-productive) were less than the 854 drilled in 1958. Test-well drilling totaled 4,096,127 feet—each well averaged 4,953 feet, compared with 4,222 feet in 1958. The 4,532 field-development wells drilled totaled 16,199,444 feet—each well averaged 3,574 feet, compared with 3,165 feet in 1958. Thus, the industry drilled deeper for oil and gas in 1959 than in any previous year.

TABLE 7.—Production of crude petroleum

(Thousand barrels and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	186,065	$491,248	1957	214,661	$650,423
1955	202,817	563,830	1958	200,699	594,069
1956	215,862	600,096	1959 [1]	196,487	573,742

[1] Preliminary figures.

TABLE 8.—Indicated demand, production, and stocks of crude petroleum in 1959, by months, in thousand barrels

Month	Indicated demand	Production	Stocks originating in Oklahoma	Month	Indicated demand	Production	Stocks originating in Oklahoma
January	17,392	17,154	17,170	September	15,124	15,182	15,600
February	15,784	15,924	17,310	October	16,074	16,250	15,776
March	17,128	17,451	17,633	November	14,782	16,402	17,396
April	16,824	17,143	17,952	December	16,109	17,126	18,413
May	17,041	16,978	17,889				
June	16,219	16,068	17,738	Total:			
July	16,684	15,545	16,599	1959	195,483	196,487	
August	16,322	15,264	15,542	1958	201,907	200,699	

TABLE 9.—Production of crude petroleum by fields, in thousand barrels

[Oil and Gas Journal]

Field	1955	1956	1957	1958	1959[1]
Allen	1,733	1,638	1,608	1,590	1,676
Bebee	836	745	707	625	606
Bradley	2,170	3,169	3,053	2,741	2,898
Burbank	10,139	13,519	14,280	14,548	14,463
Cache Creek	707	661	721	827	910
Cement	4,186	4,372	4,061	4,405	4,222
Cumberland	1,841	1,944	1,812	1,474	1,407
Cushing	2,823	2,549	2,650	2,702	2,585
Davenport	1,133	1,338	1,289	959	855
Dilworth	1,135	921	677	517	453
Doyle	2,683	3,056	2,798	2,421	2,241
Elk City	6,277	5,326	4,078	2,806	2,113
Eola	2,193	3,566	3,886	3,188	3,863
Fitts	872	785	723	800	910
Garber	692	862	849	826	876
Glenn Pool	1,983	1,901	2,259	2,773	3,164
Golden Trend	(2)	20,204	17,245	13,106	10,627
Healdton	2,307	2,347	2,260	2,331	2,256
Hewitt	3,411	3,495	3,240	3,084	2,977
Holdenville—East	1,476	1,117	628	476	412
Hoover—Northwest	1,662	2,063	1,863	2,417	2,039
Knox	1,143	1,291	1,232	1,045	941
Loco	1,370	1,606	1,542	1,372	1,290
Lucien	797	951	817	743	749
Moore—West			3,250	2,553	1,527
Naval Reserve	1,022	1,102	1,409	1,498	1,667
Oklahoma City	3,803	3,743	3,482	3,290	3,050
Olympic	2,662	1,752	1,573	1,341	1,101
Payson—East	918	786	467	(2)	423
Ringwood	551	484	(2)	(2)	(2)
Seminole:					
Bowlegs	718	685	655	619	665
Little River	699	571	478	430	390
St. Louis	1,672	1,486	1,443	1,410	1,379
Seminole	921	827	912	876	797
Sho-Vel-Tum	30,316	29,717	29,008	25,823	25,175
West Edmond	1,733	1,945	1,292	1,153	1,013
Witcher	439	378	(2)	(2)	(2)
Yale-Quay	1,479	1,322	1,765	1,927	1,700
Other fields[3]	102,315	91,638	94,649	92,003	93,067
Total	202,817	215,862	214,661	200,699	196,487

[1] Preliminary figures.
[2] Included in "Other fields."
[3] Bureau of Mines figures.

Perhaps the greatest oil and gas discovery of the year was in the northwestern Anadarko basin where a major gas-distillate-oil area continued to be developed and showed good prospects for further growth. Most of the production came from the Morrow, Hoover, Redfork, Tonkawa, Oswego, Springer, Chester, and Hunton zones at depths ranging from 5,000 to 14,000 feet. Indications were that the area had become a major gas-distillate reserve with a less important oil reserve.

In the south-central section, continued drilling into Ordovician formations in Cleveland and McClain Counties yielded several important discoveries. Osage County again was extensively drilled, but only 3 oil discoveries were made in 46 tests. Beaver County had 17 oil discoveries; McClain and Texas had 11 each; and Major, Kingfisher, and Pottawatomie had 5 each. Intensified drilling (98 test wells) in Kiowa County resulted in only 2 oil-producing wells.

An engineering study[3] by the Federal Bureau of Mines concluded that approximately 850 acres of the Muskogee and Timber Ridge sands of the Muskogee oilfield were favorable for waterflood development.

Oklahoma had 15 refineries operating with a total daily capacity of 409,680 barrels of crude oil and a total daily capacity of 151,375 barrels of cracked gasoline representing a 4-percent gain for each commodity. In 1959 these refineries processed about 68 percent of State annual production. Crude oil runs to stills, compared with total receipts, intrastate receipts, and ending stocks at these refineries for 1959 and 1958 were as follows, in thousand barrels:

Year	Runs to stills	Total receipts	Intrastate receipts	Yearend stocks
1958	126, 533	126, 084	94, 789	2, 646
1959	134, 577	134, 799	93, 747	2, 786

Upgrading of motor fuels continued at a slower pace. At its West Tulsa refinery, The Texas Co. was constructing alkylation and isomerization units. The first unit was to have a capacity of 2,050 barrels of high-octane alkylate daily; the second a capacity of 600 barrels of isobutane daily.

NONMETALS

Oklahoma has abundant resources of nonmetallic minerals and produced $37.1 million more of nonmetals than the previous record of $32.9 million established in 1958. This was reflected in the gain of overall construction in 1959. Lime was the only one of the principal construction materials that did not show a value gain.

Asphalt (Native).—Output of native rock asphalt for road surfacing, reported from Murray County, was 72 percent lower than output in 1958.

Cement.—Production of cement, the leading nonmetal in terms of value produced in Oklahoma, gained about 15 percent. Cement shipments into the State gained 5 percent. Two plants (at Dewey in Washington County and at Ada in Pontotoc County) were active. At Ada, Ideal Cement Co. continued producing cement from its new

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[3] Riggs, C. H. and others, Petroleum Engineering Study of the Muskogee Oilfield, Muskogee County, Okla. Bureau of Mines Rept. of Investigations 5448, 1959, 40 pp.

TABLE 10.—Oil and gas wells drilled in 1959, by counties [1]

County	Proved field wells				Exploratory wells			Total
	Oil	Gas	Service	Dry	Oil	Gas	Dry	
Alfalfa	52	9	-------	13	4	1	8	87
Atoka	-------	-------	-------	-------	-------	-------	4	4
Beaver	63	97	-------	48	17	20	16	261
Beckham	4	1	-------	2	1	1	9	18
Blaine	1	1	-------	-------	-------	1	1	4
Bryan	1	2	-------	2	-------	-------	4	9
Caddo	86	2	-------	10	1	-------	13	112
Canadian	-------	-------	-------	-------	-------	-------	1	1
Carter	136	-------	1	33	3	-------	6	179
Choctaw	-------	-------	-------	-------	-------	-------	1	1
Cimarron	3	7	-------	15	2	4	15	46
Cleveland	51	1	2	19	4	-------	19	96
Coal	5	1	-------	3	-------	-------	5	14
Comanche	32	-------	-------	33	1	-------	8	74
Cotton	21	-------	-------	14	-------	1	11	47
Craig	-------	-------	-------	-------	-------	-------	8	8
Creek	191	3	13	98	1	-------	4	310
Custer	-------	-------	-------	-------	-------	2	1	3
Dewey	1	-------	-------	-------	3	2	5	11
Ellis	4	2	-------	1	3	5	12	27
Garfield	28	1	1	19	2	-------	8	59
Garvin	80	5	1	39	1	-------	6	132
Grady	6	1	-------	6	1	-------	4	18
Grant	31	7	-------	19	3	3	12	75
Greer	-------	2	-------	12	-------	4	13	31
Harmon	-------	-------	-------	-------	-------	-------	1	1
Harper	30	65	1	12	4	4	15	131
Haskell	-------	2	-------	1	-------	-------	2	5
Hughes	36	15	-------	24	-------	1	6	82
Jackson	-------	-------	1	1	-------	-------	5	7
Jefferson	21	2	-------	17	-------	-------	15	55
Johnston	-------	-------	-------	-------	-------	-------	2	2
Kay	76	1	4	40	3	1	18	143
Kingfisher	12	1	-------	-------	5	-------	2	20
Kiowa	106	-------	2	157	2	-------	96	363
Le Flore	-------	-------	-------	1	-------	-------	-------	1
Lincoln	61	13	3	42	3	-------	16	138
Logan	26	2	1	13	2	1	10	55
Love	17	-------	-------	13	2	-------	10	42
McClain	127	1	-------	19	11	-------	12	170
McCurtain	-------	-------	-------	3	-------	-------	4	7
McIntosh	-------	3	-------	6	-------	1	12	22
Major	14	-------	-------	6	5	-------	6	31
Marshall	39	-------	-------	16	-------	-------	3	58
Mayes	-------	-------	-------	-------	-------	-------	1	1
Murray	8	-------	-------	9	2	-------	12	31
Muskogee	26	-------	-------	17	-------	-------	7	50
Noble	59	1	1	43	3	-------	12	119
Nowata	-------	-------	-------	-------	-------	-------	1	1
Okfuskee	105	7	3	43	2	1	5	166
Oklahoma	16	5	-------	9	2	-------	8	40
Okmulgee	159	5	42	88	-------	1	-------	295
Osage	356	1	31	170	3	-------	46	607
Pawnee	55	-------	1	21	1	-------	8	86
Payne	26	-------	2	31	-------	-------	8	67
Pittsburg	-------	1	-------	3	-------	2	3	9
Pontotoc	45	3	-------	29	-------	-------	5	82
Pottawatomie	54	-------	-------	24	5	1	9	93
Roger Mills	-------	-------	-------	-------	-------	-------	1	1
Seminole	161	8	1	77	-------	-------	7	254
Sequoyah	-------	-------	-------	-------	-------	-------	4	4
Stephens	159	7	-------	75	3	-------	12	256
Texas	39	30	1	19	11	12	21	133
Tillman	25	-------	-------	13	-------	-------	15	53
Wagoner	-------	-------	-------	1	-------	-------	1	2
Washington	4	-------	-------	-------	-------	-------	-------	4
Washita	2	-------	-------	-------	-------	-------	2	4
Woods	2	3	-------	3	1	1	9	19
Woodward	4	1	-------	3	-------	3	11	22
Total:								
1959	[2] 2,666	319	112	1,435	[2] 117	73	637	5,359
1958	[2] 3,232	300	305	1,663	[2] 141	40	673	6,354

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[1] Oil and Gas Journal, vol. 58, No. 4, Jan. 25, 1960.
[2] Includes distillate wells.

$20 million plant, which had a capacity of 3 million barrels annually, and put its old Ada plant on standby status. Dewey Portland Cement Co. was constructing on a 1,500-acre tract, just east of Tulsa, a $12 million plant capable of producing 1.25 million barrels of cement per year. Plans called for gradual closing of the Dewey plant as the market hub was shifted to Tulsa.

TABLE 11.—Destination of shipments of all types of finished portland and high-early-strength cement to Oklahoma from mills

Year	Oklahoma (thousand barrels)	Change, percent	
		In Oklahoma	In United States
1950–54 (average)	4,276		
1955	4,789	+10	+6
1956	4,814	+1	+6
1957	4,886	+1	−6
1958	5,131	+5	+6
1959	5,374	+5	+9

Clays.—Clay production was used primarily in manufacturing brick and tile and, to a lesser extent, in manufacturing portland cement and lightweight expanded clay products. Brick and tile were produced in Creek, Custer, Garfield, Greer, Lincoln, Oklahoma, Pittsburg, Seminole, and Tulsa Counties. Expanded lightweight aggregate was made from clay in Tulsa and Oklahoma Counties. Pottery was manufactured in Creek County. Equal quantities of bentonite, produced in Dewey County, were used for filtering and as an absorbent.

TABLE 12.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	531	$711	1957 [1]	641	$642
1955 [1]	724	727	1958 [1]	576	579
1956 [1]	705	701	1959 [1]	966	970

[1] Excludes bentonite.

Gem Stones.—A minor quantity of gem stones (valued at $1,000) was reported by individuals mainly in Cleveland, Ottawa, Pontotoc, and McCurtain Counties. The materials were essentially crystalline specimens of quartz, barite, calcite, and selenite.

Gypsum.—Production of gypsum rose to meet the growing demand for wallboard, plaster, portland cement, and agriculture. Most of the gypsum was produced in Blaine County, where United States Gypsum Co. operated quarries and plants at Southard to manufacture wallboard and plasters. Other production was reported from Caddo and Washita Counties.

Lime.—Lime production in the State, all by St. Clair Lime Co. in Sequoyah County, declined during the year. Consumption was mostly by chemical plants at Pryor and for treating water at municipal plants.

Pumice.—A substantial gain in the production of pumice was reported by one operator in Beaver County, although tonnage was still relatively small. Principal use was for abrasive-type cleanser.

Salt.—Output of salt, reported by two producers in two counties, declined 59 percent from 1958. In Woods County, salt was produced from surface incrustations on the Big Salt Plain of the Cimarron River; in Harmon County, it was recovered by solar evaporation of brine from springs. Principal uses were for stock food and for recharging water softeners. Minor uses were as a herbicide on ranches and for salinity control of oil-well drilling fluid.

Sand and Gravel.—Sand and gravel production was reported from 59 counties; Johnston, Tulsa, Logan, Oklahoma, Pontotoc, Kay, Muskogee, and Murray supplied two-thirds of the total value.

Most of the sand and gravel produced in Oklahoma was used for concrete aggregate. High-purity glass sand, second in tonnage and value, was produced by two plants in Johnston and Pontotoc Counties (Arbuckle Mountain district). In addition to use in glass manufacturing, a small part of the high-purity sand was used as foundry sand, for making sodium silicate, and for use in pottery and tile.

TABLE 13.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	2,491	$2,424	1,644	$799	4,135	$3,223
1955	3,654	3,719	2,640	1,067	6,294	4,786
1956	3,417	3,886	2,530	957	5,947	4,843
1957	3,297	3,608	1,663	899	4,960	4,507
1958	4,245	4,417	2,987	1,442	7,232	5,859
1959	4,376	4,988	1,626	939	6,002	5,927

Stone.—Comanche, Tulsa, Murray, and Ottawa Counties supplied most of the 13 million tons of stone produced from 37 counties. Production of crushed limestone was reported by 20 producers at 37 quarries and by the State highway department. The material was used principally for manufacturing cement and concrete aggregate and for road construction. Smaller quantities were used as agricultural limestone, and for glass manufacturing.

Chat.—Chat, tabulated with miscellaneous stone, is the coarse tailing from milling zinc and lead ores. The material is mostly chert (microcrystalline silica) with small quantities of limestone, sphalerite, galena, marcasite, and pyrite. Most of the chat sold was used for railroad ballast, concrete aggregate, and road surfacing. Operators in Ottawa County reported 2 percent less production than in 1958.

Granite.—The dimension-granite industry of Oklahoma is centered in the Wichita Mountains in the southwestern part of the State, where five producers operated seven quarries in Greer and Kiowa Counties. One quarry was operated in Johnston County in the Arbuckle Mountains. In Jackson and Kiowa Counties granite was quarried and crushed for riprap and roadstone by two producers.

TABLE 14.—Stone sold or used by producers, by kinds

(Thousand short tons and thousand dollars)

Year	Granite		Limestone		Sandstone		Other stone		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1955	576	$1,276	[1] 8,827	[1] $10,124	237	$276	1,293	$619	10,933	$12,295
1956	[2] 5	[2] 523	[1] 8,626	[1] 10,603	153	227	1,763	1,064	10,547	12,417
1957	[2] 5	[2] 557	[1] 10,238	[1] 12,041	306	373	1,467	1,092	12,016	14,064
1958	31	569	9,383	10,833	275	264	1,105	566	10,794	12,232
1959	[2] 5	720	11,242	13,455	222	241	1,214	564	12,683	14,980

[1] Dimension limestone included with "Other stone."
[2] Crushed granite included with "Other stone."

Production was from Precambrian granites, which are predominantly pink and red. Dimension granite was used mostly for monuments and partly for exterior trim. Much of the stone was finished in plants in the Wichita Mountains; some was shipped as rough rock to other States.

Limestone and Dolomite.—Limestone and dolomite were quarried in 28 counties; the largest production was from Comanche, Tulsa, and Murray Counties.

Chemical-grade limestone was quarried at Marble City in Sequoyah County for limemaking, for use as flux in glass manufacturing, and for fertilizers and mineral food. About 2,600 short tons of dimension limestone was quarried for building stone in the Arbuckle Mountains in Pontotoc, Caddo, and Johnston Counties, and in the Wichita Mountains in Jackson County; limestone for portland cement was quarried in Washington and Pontotoc Counties.

Dolomite was quarried in Johnston County for flux in glass manufacturing and for fertilizers.

Sandstone.—Dimension sandstone produced in Okmulgee and Mayes Counties was used for building and veneer stone. The stone was cut in slabs 1½ to 6 inches thick from shallow, open-face quarries.

Tripoli.—Production of tripoli in eastern Ottawa County continued during the year. The entire output was shipped to Seneca, Mo., processed by the American Tripoli Division of the Carborundum Co., and sold chiefly for buffing compounds and in minor quantities for foundry use.

Vermiculite.—Vermiculite from ores mined in Montana and South Carolina, was exfoliated in Oklahoma County by the Zonolite Co. and used mainly in concrete and plaster.

METALS

Output of metals declined for the fifth consecutive year.

Lead.—Only 601 short tons of recoverable lead was mined, all from Ottawa County because most mines remained closed during the year owing to depressed markets. Percentage of metal recovery from the ore was considerably higher because the smaller scale mining was more selective.

The price of lead, New York, at the first of the year was 13 cents per pound, dropped to a low of 11 cents on February 23, returned to 13 cents on August 24, and then dropped to 12 cents on December 21.

Zinc.—Zinc output, all from Ottawa County, declined sharply because most mines remained closed during the year. The price of zinc metal at the beginning of 1959 was quoted at 11.5 cents per pound, East St. Louis, increased to 13 cents on October 29, dropped to 12.5 cents on November 1, and then remained unchanged to the yearend.

TABLE 15.—Mine production of lead and zinc, in terms of concentrate and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	20,313	$3,630	86,959	$8,453	15,189	$4,507	46,338	$13,594
1955	19,555	3,369	78,726	5,997	14,126	4,210	41,543	10,220
1956	17,971	3,225	52,993	4,485	12,350	3,878	27,515	7,539
1957	10,198	1,896	27,702	2,288	7,183	2,054	14,951	3,469
1958	5,213	689	9,791	594	3,692	864	5,267	1,074
1959	905	118	2,090	134	601	138	1,049	241
1891–1959	1,673,711	162,679	9,733,650	482,266	1,283,752	194,192	5,132,164	771,980

[1] Based on Oklahoma ore (dirt) and old tailing treated at mills during calendar year indicated.

[2] In calculating metal content of ores from assays, allowance made for smelting losses of both lead and zinc. In comparing values of concentrate (ore) and metal, it should be borne in mind that value given for concentrate is that actually received by producer, whereas value of lead and zinc is calculated from average price for all grades.

TABLE 16.—Tenor of lead-zinc ore milled and concentrates produced

	1958	1959 [1]
Total material milled short tons	384,196	15,365
Recovery of concentrate and metal from quantity milled:		
Galena short tons	5,213	412
Sphalerite do	9,791	989
Galena percent	1.36	2.68
Sphalerite do	2.55	6.46
Lead [2] do	0.96	2.13
Zinc [2] do	1.37	3.36
Average lead content of galena concentrate do	72.28	81.07
Average zinc content of sphalerite concentrate do	59.70	58.14
Average value per ton:		
Galena concentrate	$132.23	$155.93
Sphalerite concentrate	60.70	66.71

[1] Lead-zinc concentrates from accumulated slimes excluded.

[2] Figures represent metal content of crude ore (dirt) as recovered in concentrate. Data on tailing losses not available.

TABLE 17.—Mine production of lead and zinc in 1959, by months, in terms of recoverable metals, in short tons

Month	Lead	Zinc	Month	Lead	Zinc
January	20	20	August	112	150
February	12	25	September	120	200
March	29	35	October	130	350
April	29	45	November	25	25
May	35	64	December	24	25
June	39	60			
July	26	50	Total	601	1,049

TABLE 18.—Quoted prices of 60 percent zinc concentrate and 80 percent lead concentrate at Joplin, Mo., in 1959 [1]

Zinc concentrate		Lead concentrate	
Effective date	Price per short ton	Effective date	Price per short ton
Jan. 1–Feb. 24	$68.00	Jan. 1–Jan. 21	$156.12
Feb. 25–Sept. 20	64.00	Jan. 22–Feb. 10	141.72
Sept. 21–Sept. 21	68.00	Feb. 11–Feb. 23	134.52
Sept. 21–Oct. 21	72.00	Feb. 24–Mar. 4	127.32
Oct. 22–Nov. 1	80.00	Mar. 5–Mar. 31	134.52
Nov. 2–Dec. 31	76.00	Apr. 1–Apr. 19	127.32
		Apr. 20–May 6	134.52
		May 7–Aug. 23	141.72
		Aug. 24–Dec. 13	156.12
		Dec. 14–Dec. 20	148.92
		Dec. 21–Dec. 31	141.72

[1] E&MJ Metal & Mineral Markets.

Custom Mills and Smelters.—One custom mill in Kansas treated lead-zinc ores mined in Oklahoma and Kansas.

Three horizontal-retort zinc plants were operated in Oklahoma in 1959: American Metal Climax, Inc., at Blackwell, Kay County; National Zinc Co. at Bartlesville, Washington County; and The Eagle-Picher Co. at Henryetta, Okmulgee County. Only the Henryetta smelter treated domestic ores exclusively; it operated 6 of 10 furnace blocks from April 1 to July 1 and 8 blocks thereafter. Outputs of the two other plants also were curtailed. Federated Metals Division of American Smelting and Refining Co. operated a secondary zinc plant in Sand Springs, Tulsa County.

TRI-STATE DISTRICT

Depressed lead-zinc markets, which led to a general shutdown at midyear 1958 of all major mining operations in the Tri-State Dis-

TABLE 19.—Mine production of lead and zinc concentrates in the Tri-State District, in terms of concentrate and recoverable metals

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	31,049	$5,640	143,526	$14,087	23,401	$7,005	76,535	$22,593
1955	[1] 26,992	4,734	[2] 131,026	10,052	[2] 19,679	5,864	[3] 69,696	17,145
1956	28,597	5,282	107,997	9,335	20,373	6,397	57,215	15,677
1957	15,930	2,928	57,052	4,604	11,462	3,278	30,895	7,168
1958	7,041	931	18,001	1,093	4,991	1,168	9,688	1,976
1959:								
Kansas	702	93	1,971	148	481	111	1,017	234
Southwest Missouri	--------	--------	--------	--------	--------	--------	--------	--------
Oklahoma	905	118	2,090	134	601	138	1,049	241
Total: 1959	1,607	211	4,061	282	1,082	249	2,066	475

[1] Includes 2,736 tons from old tailing remilled.
[2] Includes 44 tons from old tailing remilled.
[3] Includes 256 tons from old tailing remilled.

trict, prevailed throughout 1959. Consequently, the quantities of lead and zinc concentrates recovered were down 77 percent each from 1958 recoveries. Oklahoma produced 44 percent of the district's lead concentrate and 49 percent of the zinc concentrate; and Kansas, 56 percent of the district's lead concentrate and 51 percent of the zinc concentrate. Southwest Missouri had no production in 1959.

Mineral Brokers.—Three smelting companies maintained mineral brokers or ore buyers in the Tri-State District of Oklahoma, Kansas,

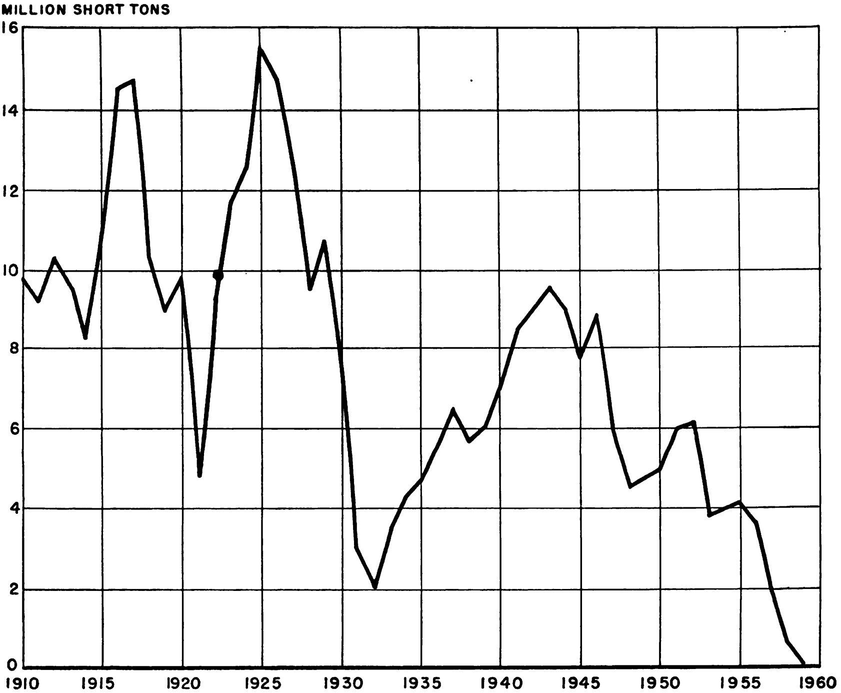

FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State District, 1910–59.

TABLE 20.—Tenor of lead and zinc ore milled and concentrate produced in Tri-State District

	1955	1956	1957	1958	1959[1]
Total material milled:					
Crude ore short tons	4,140,281	3,584,902	1,836,942	611,556	31,750
Tailing and slimes do	486,280				
Recovery of concentrate and metal from material milled:					
Galena percent	0.58	0.80	0.87	1.15	2.58
Sphalerite do	2.83	3.01	3.11	2.94	6.71
Lead[2] do	0.43	0.57	0.62	0.82	2.05
Zinc[2] do	1.51	1.60	1.68	1.58	3.54
Average lead content of galena concentrate do	74.41	72.69	73.46	72.35	81.17
Average zinc content of sphalerite concentrate percent	59.09	58.87	60.16	59.76	58.54
Average value per ton:					
Galena concentrate	$175.40	$184.72	$183.80	$132.29	$154.95
Sphalerite concentrate	76.72	86.44	80.70	60.74	73.49

[1] Lead-zinc concentrates from accumulated slimes excluded.
[2] Figures represent metal content of crude ore (dirt) as recovered in concentrate.

and southwest Missouri. No metal concentrates were stockpiled at the mines, as all production continued to be purchased f.o.b. mill by the brokers. Mills were operated only part time during the year, as deliveries of mined ores were small.

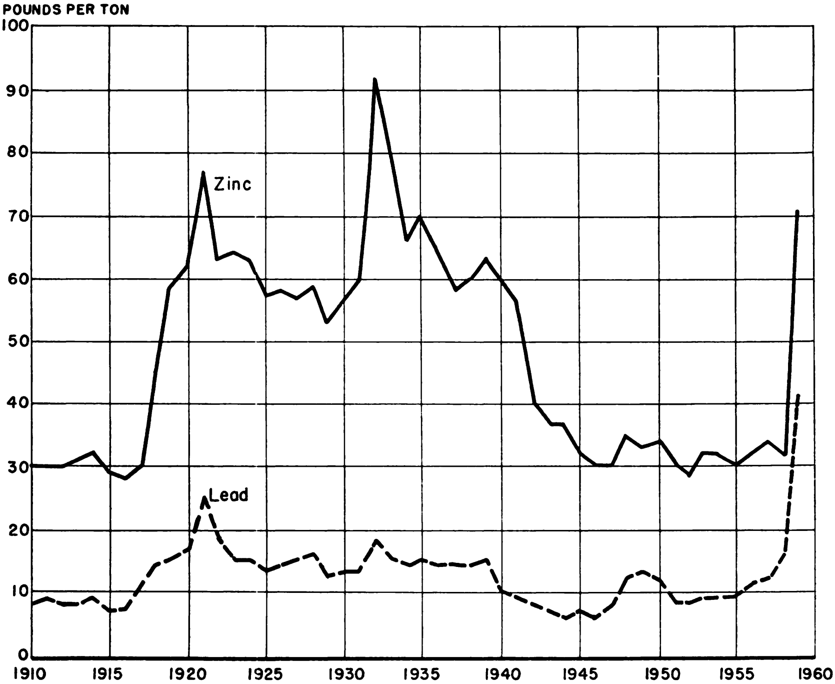

FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State District, 1910–59.

REVIEW BY COUNTIES

Production of metals, nonmetals, and mineral fuels was reported from 76 of Oklahoma's 77 counties.

Alfalfa.—Petroleum and natural gas were produced. Construction sand and gravel was produced by Earl Kirkpatrick, and paving sand by the State highway department.

Atoka.—Limestone was mined and crushed at Southwest Stone Co. quarry near Stringtown for use as railroad ballast, riprap, road base, and aggregate in concrete. Sand and gravel was produced by the State highway department. A small quantity of petroleum was produced.

Beaver.—Petroleum, natural gas, and natural-gas liquids were produced. The Mocane gas area was the largest in the county. LaRue-Axtell Pumice Co. mined volcanic ash near Gate. Sand and gravel was produced by the State highway department.

Beckham.—Petroleum, natural gas, and natural-gas liquids were produced, mostly from the Elk City field. Sand and gravel was produced by the State highway department.

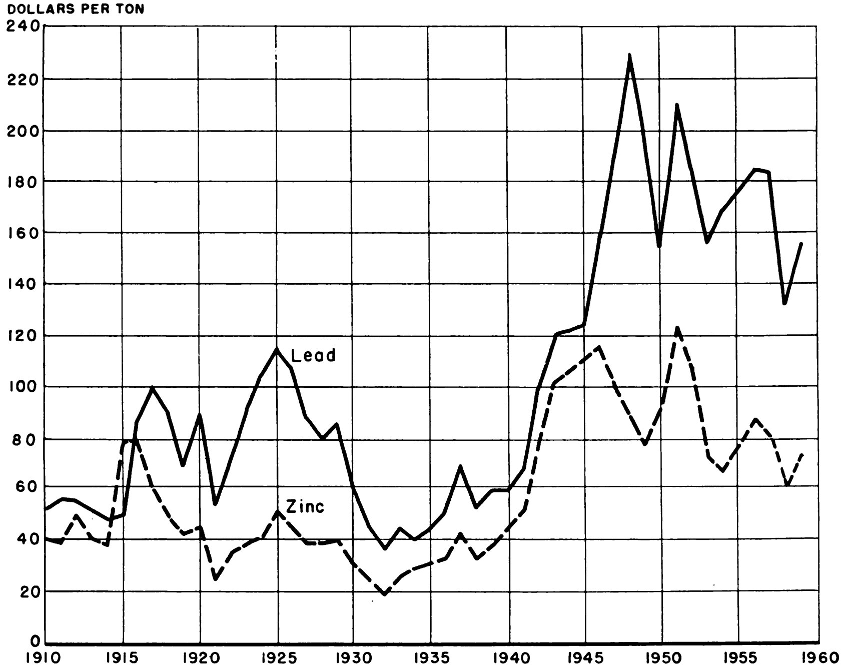

FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State District, 1910–59.

TABLE 21.—Value of mineral production in Oklahoma, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Adair	$13,683	$7,508	Stone, petroleum.
Alfalfa	2,587,921	2,920,168	Petroleum, natural gas, sand and gravel.
Atoka	(1)	(1)	Stone, sand and gravel, petroleum.
Beaver	9,110,382	10,134,262	Natural gas, petroleum, natural-gas liquids, pumice, sand and gravel.
Beckham	15,246,188	12,210,042	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Blaine	1,189,177	1,520,832	Gypsum, sand and gravel, petroleum, natural gas, stone.
Bryan	1,580,803	1,836,429	Petroleum, stone, natural gas, sand and gravel.
Caddo	16,495,572	16,155,728	Petroleum, natural gas, stone, gypsum, sand and gravel.
Canadian	226,336	342,176	Petroleum, natural gas.
Carter	61,767,720	62,330,455	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Cherokee	392,116	(1)	Stone.
Choctaw	27,000	149,860	Sand and gravel.
Cimarron	2,655,437	3,145,389	Helium, natural gas, petroleum.
Cleveland	20,163,176	17,683,675	Petroleum, natural-gas liquids, natural gas, gem stones, sand and gravel.
Coal	1,986,612	2,099,592	Petroleum, stone, natural gas, sand and gravel.
Comanche	3,178,753	(1)	Stone, petroleum, natural gas, sand and gravel.
Cotton	4,621,155	4,519,744	Petroleum, sand and gravel, natural gas.
Craig	373,846	618,786	Coal, petroleum, stone, natural gas.
Creek	31,115,222	30,984,225	Petroleum, natural-gas liquids, natural gas, clays, stone.
Custer	310,495	677,811	Natural-gas liquids, stone, sand and gravel, clays, natural gas.
Delaware	7,100	-------------	
Dewey	(1)	72,674	Bentonite, petroleum, natural gas.
Ellis	118,605	94,746	Petroleum, natural gas.
Garfield	7,491,811	6,811,660	Petroleum, natural-gas liquids, natural gas, clays.
Garvin	87,668,653	86,753,449	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.

See footnotes at end of table.

TABLE 21.—Value of mineral production in Oklahoma, by counties—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Grady	$19,632,876	$18,563,565	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Grant	4,183,374	4,139,550	Petroleum, natural gas.
Greer	430,745	296,935	Petroleum, sand and gravel, clays, natural gas, stone.
Harmon	14,101	(1)	Salt, sand and gravel.
Harper	1,627,196	5,292,022	Natural gas, natural-gas liquids, petroleum.
Haskell	2,120,898	2,138,279	Coal, natural gas, sand and gravel.
Hughes	7,637,969	6,119,448	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jackson	558,806	708,646	Petroleum, stone, sand and gravel, natural gas.
Jefferson	3,819,896	4,182,015	Petroleum, natural gas, sand and gravel, stone.
Johnston	1,416,317	1,664,006	Sand and gravel, stone.
Kay	13,882,207	13,418,268	Petroleum, natural-gas liquids, sand and gravel, natural gas, stone.
Kingfisher	1,432,657	1,496,619	Petroleum, sand and gravel, natural gas, natural-gas liquids.
Kiowa	3,435,659	2,293,493	Petroleum, stone, natural gas, sand and gravel.
Latimer	338,330	40,488	Natural gas.
Le Flore	5,210,292	2,494,294	Coal, natural gas, stone, sand and gravel.
Lincoln	21,324,382	22,394,428	Petroleum, natural-gas liquids, natural gas, stone, clays, sand and gravel.
Logan	11,780,409	10,044,549	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Love	2,373,510	2,048,075	Petroleum, natural gas, sand and gravel.
Major	1,890,786	2,457,018	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Marshall	7,221,132	7,296,208	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Mayes	(1)	(1)	Stone, petroleum.
McClain	12,571,263	19,927,011	Petroleum, natural gas, natural-gas liquids, sand and gravel.
McCurtain	158,935	132,718	Sand and gravel, stone, petroleum, gem stones.
McIntosh	582,058	(1)	Coal, natural gas, petroleum, sand and gravel.
Murray	3,942,265	3,628,991	Petroleum, stone, sand and gravel, asphalt, natural gas.
Muskogee	1,083,317	1,765,821	Petroleum, sand and gravel, natural gas.
Noble	9,173,749	8,580,757	Petroleum, natural gas, natural-gas liquids, stone.
Nowata	13,125,597	9,609,416	Petroleum, stone, coal, natural gas.
Okfuskee	10,558,553	9,329,496	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Oklahoma	28,559,244	27,384,990	Petroleum, natural-gas liquids, natural gas, sand and gravel, clays.
Okmulgee	7,533,535	7,511,803	Petroleum, coal, stone, natural gas, sand and gravel.
Osage	75,744,249	75,312,857	Petroleum, natural-gas liquids, stone, natural gas, sand and gravel.
Ottawa	2,541,178	1,025,116	Stone, zinc, lead, tripoli, gem stones.
Pawnee	7,407,886	6,628,247	Petroleum, stone, sand and gravel, natural-gas liquids, natural gas.
Payne	13,745,588	11,807,252	Petroleum, natural gas, stone, natural-gas liquids, sand and gravel.
Pittsburg	1,889,759	(1)	Coal, natural gas, sand and gravel, clays.
Pontotoc	17,907,482	19,585,783	Cement, petroleum, stone, natural-gas liquids, clays, sand and gravel, natural gas, gem stones.
Pottawatomie	12,990,819	12,408,635	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Pushmataha	201,497	(1)	Sand and gravel.
Roger Mills	4,000	7,500	Do.
Rogers	6,350,169	5,969,481	Petroleum, coal, clays, natural gas.
Seminole	28,898,595	30,459,023	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Sequoyah	2,567,323	2,258,323	Coal, lime, stone, natural gas, sand and gravel.
Stephens	65,742,982	67,612,828	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Texas	26,605,717	21,593,553	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Tillman	2,490,152	2,549,190	Petroleum, sand and gravel, natural gas.
Tulsa	7,139,753	7,162,916	Petroleum, stone, sand and gravel, clays, natural gas.
Wagoner	1,962,529	2,151,505	Petroleum, sand and gravel, natural gas.
Washington	19,220,756	21,020,963	Petroleum, cement, stone, clays, natural gas, sand and gravel.
Washita	1,240,796	1,086,541	Petroleum, natural gas, sand and gravel, gypsum.
Woods	746,624	556,997	Natural gas, petroleum, sand and gravel, salt.
Woodward	38,265	35,182	Petroleum, sand and gravel, natural gas.
Various	80,119	36	Gem stones.
Undistributed	472,430	6,646,946	
Total	[2] 761,936,000	751,907,000	

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[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Revised figure.

Blaine.—Gypsum was produced northeast of Watonga by Universal Atlas Cement Co. and west of Okeene by S. A. Walton & Sons. U.S. Gypsum Co. quarried and crushed gypsum and operated a large calcining, sheetrock, and plaster plant at Southard. Construction sand and gravel was produced by Tindle Material Co. Minor quantities of petroleum, natural gas, and crushed limestone were produced.

Bryan.—Sand and gravel for construction was produced from pits near Colbert, and elsewhere for paving by the State highway department. Petroleum and natural gas were produced from Aylesworth, S. E. field. Limestone was quarried and crushed for highways.

Caddo.—Petroleum and natural gas were produced. Cement, the largest field, produced 4.2 million barrels of oil. At Cyril, the 12,000-barrel-a-day refinery of Anderson-Prichard Oil Corp. operated throughout the year. Construction sand and gravel was produced by one operator; paving sand by the State highway department. Dimension limestone, crushed limestone, and crushed sandstone were produced. Gypsum for portland cement and agriculture was produced near Lindsay by Harrison Gypsum Co.

Carter.—Carter County ranked fourth in the value of minerals and mineral fuels produced in the State. Petroleum and natural gas were produced from numerous fields; Fox-Graham, Healdton, Hewitt, and Sho-Vel-Tum were the largest. Natural-gas liquids were recovered by five plants. At Ardmore, the 12,000-barrel-a-day refinery of Ben Franklin Refining Co. operated during the year. Sand and gravel was produced by the State highway department.

Cimarron.—Petroleum and natural gas were produced from several small fields in the Keyes area. At Keyes, helium gas was recovered by the new $12 million plant of the Federal Bureau of Mines. This plant, designed to produce 290 million cubic feet of helium annually, employed 86 persons. Gas for processing at Keyes was supplied to the plant by Colorado Interstate Gas Co.

Cleveland.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by plants of Continental Oil Co. and Sunray Mid-Continent Petroleum Corp. Sand and gravel was produced by the State highway department. Barite crystals were collected and sold as gem stones by three hobby shops.

Coal.—Petroleum and natural gas valued at about $1.8 million were produced. Crushed limestone was produced near Bromide by Dolese Bros., and paving sand and gravel by the State highway department.

Comanche.—Crushed limestone was produced by Dolese Bros. Co. from its Richard Spur quarry north of Lawton. Paving sand was produced by the State highway department. Petroleum and natural gas were produced from a group of small fields (comprising three districts) and Fort Sill Reservation field.

Cotton.—Petroleum and natural gas were produced from a group of fields in the Walters and Cache Creek districts and from several other fields. Sand and gravel was produced by the State highway department.

Craig.—Coal was strip mined at four pits by three producers. Minor amounts of petroleum and natural gas were produced. Limestone was quarried and crushed by various producers.

Creek.—Petroleum and natural gas were produced from numerous fields; of these, the prolific Cushing and Glennpool fields furnished 5.7 million barrels of petroleum during the year. Natural-gas liquids were recovered by five plants. At Sapulpa, clay for manufacturing brick and tile was produced by Sapulpa Brick & Tile Co. and for pottery by Frankhoma Pottery Co. A minor quantity of crushed limestone was produced for riprap.

Garfield.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by plants of Sterling Oil Co. of Oklahoma near the East Spring Valley field and by Sinclair Oil & Gas Co. at Covington. The 32,000-barrel-a-day Enid refinery of Champlin Refining Co. operated throughout the year. Enid Brick & Tile Manufacturing Co. continued to produce clay for manufacturing brick.

Garvin.—Garvin County remained in first position in total value of minerals and mineral fuels produced in the State, although it ranked third in petroleum production. Petroleum and natural gas, produced from numerous fields, furnished 19 million barrels of petroleum. Natural-gas liquids were recovered by six plants. The 17,500-barrel-a-day refinery of Kerr-McGee Oil Industries, Inc., at Wynnewood operated all year. Construction sand was mined by one operator from deposits east of Pauls Valley; paving sand and gravel, and crushed sandstone were produced for highways by the State highway department.

Grady.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by two gasoline plants and one cycling plant. Sand and gravel for construction and paving was obtained from pits near Tuttle by Dolese Bros. Co.

Greer.—Petroleum and natural gas were produced from the Lake Creek district. Granite was quarried by J. P. Gilman Granite Co. and Fairfax Granite, Inc., near the town of Granite. Clay was produced from the pit of Mangum Brick & Tile Co., south of Mangum. Sand and gravel was produced by two operators.

Harper.—Petroleum and natural gas were produced. Natural-gas liquids were recovered by Sun Oil Co. new $3.5 million gasoline plant, designed to process 100 million cubic feet of gas daily from the big Laverne gasfield.

Haskell.—Haskell County ranked second in value of coal produced. Coal was mined underground by McAlpine and Dock Coal Co. and strip mined by four other producers. Natural gas was produced from Quinton and Kinta districts, where new drilling interest developed. A minor quantity of sand and gravel was produced by the State highway department.

Hughes.—Petroleum and natural gas were produced from numerous fields. The Holdenville, East field, discovered in 1946, produced 412,000 barrels of oil. Natural gas liquids were recovered by Grimes Gasoline Co. Paving gravel was produced for highways.

Jackson.—Small amounts of petroleum and natural gas were produced from fields southeast of Altus. Crushed granite was produced by H. D. Youngman Co. at Hedrick for Altus Air Base. Dimension limestone was quarried by Masters Stone Co. Paving sand and gravel was produced by various operators.

Jefferson.—Petroleum and natural gas were produced. Sand for road construction was produced by the State highway department. Sandstone was quarried and crushed by various producers.

Johnston.—Pennsylvania Glass Sand Corp. of Oklahoma continued to produce glass sand and ground silica from pits north of Mill Creek. Construction sand from a pit east of Tishomingo and paving gravel were produced for highways. Dimension limestone for construction was produced near Pontotoc by Ada Stone Co. and crushed sandstone for road construction by Rock Products Co. Dimension granite was quarried south of Mill Creek by Century Granite Works.

Kay.—Petroleum and natural gas were produced from numerous fields; natural-gas liquids were recovered by plants of Cities Service Oil Co. and Underlich Development Co. Petroleum refineries of Cities Service Oil Co. and Continental Oil Co. at Ponca City operated all year. The petrochemical units of the Continental Oil Co. refinery continued to produce benzene, toluene, propylene hydrocarbons, and carbon black. Effective July 1, 1959, the American Metals Climax, Inc., zinc smelter at Blackwell cut zinc slab production 4,000 tons a year. Crushed limestone was produced by Cookson Stone Co. from its quarry and plant northeast of Ponca City and by Mervine Stone Co. Sand was produced for construction and paving by two operators and by the State highway department.

Kingfisher.—Construction and paving sand were produced from pits near Dover by Dolese Bros. Co. and by the Federal Bureau of Reclamation, and paving sand by the State highway department. Petroleum, natural gas, and natural gasoline were produced. Natural-gas liquids were recovered by the Trindle plant of Sohio Petroleum Co.

Kiowa.—Dimension granite was quarried near Snyder by three operators and near Hobart by Century Granite Co. Construction sand and gravel and crushed limestone for highways were produced by three operators. Petroleum and natural gas were produced.

Le Flore.—Seven operators mined coal, one by strip mining and six by underground mining. The county was the third leading coal producer in the State. Sand and gravel and crushed sandstone were produced for highway surfacing. Natural gas was produced, mainly from three fields.

Lincoln.—Petroleum and natural gas were produced from numerous fields. Natural-gas liquids were recovered by five plants. Allied Materials Corp.'s 3,500-barrel-a-day refinery at Stroud operated throughout the year. Crushed limestone was produced at three quarries by two operators and sand for concrete aggregate by the State highway department. Stroud Clay Products Co. produced clay for building brick.

Logan.—Petroleum and natural gas were produced from numerous fields and natural-gas liquids were recovered by plant No. 3 of Eason Oil Co. Construction sand was produced by two operators.

Major.—Petroleum and natural gas were produced mostly from the Ringwood field and from other smaller fields. Natural-gas liquids were recovered by Warren Petroleum Co. at Ringwood. Construction sand was produced by one operator.

Marshall.—Petroleum and natural gas were produced from several fields in 1959; Cumberland field yielded 1.4 million barrels of oil. Natural-gas liquids were recovered by Warren Petroleum Corp. and Universal Gasoline Co. Near Madill, sulfur from waste sour gas was recovered by Central Chemical Co. Sand and gravel and crushed limestone were produced for highways.

McClain.—Petroleum and natural gas were produced from numerous small fields and natural gasoline by the Criner plant of Sunray Mid-Continent Oil Co. Sand and gravel for paving was produced by the State highway department.

McIntosh.—Coal was strip mined by Magic City Coal Co. Small amounts of petroleum and natural gas were produced, mostly from the Coalton and Stidham fields. Sand was produced for highways.

Murray.—Asphaltic limestone and sandstone were produced near Dougherty by United States Asphalt Corp. Limestone was mined and crushed at the Rayford and Big Canyon quarries of Dolese Bros. Co. and elsewhere by various producers. Structural sand was produced by Makin Sand & Gravel Co., and sand and gravel for highways by the State highway department. Petroleum and natural gas were produced from two fields.

Muskogee.—Petroleum and a small quantity of natural gas were produced. Sand and gravel was pumped from the Arkansas River by three producers and by the State highway department. At Muskogee, Fansteel Metallurgical Corp. operated its new $6.5 million columbium-tantalum plant, which was designed to increase the domestic supply of tantalum by 50 percent. At Muskogee, Callery Chemical Co. resumed operating its $38 million energy-fuel plant to produce HiCal on a reduced scale after brief suspension of its contract with the Defense Department.

Noble.—Petroleum and natural gas were produced from numerous fields, and natural-gas liquids were recovered by the Lucien unit plant of Gasoline Plant Management Co. Stone for riprap was quarried by various producers.

Nowata.—Petroleum and natural gas were produced from six fields. Crushed limestone was produced by Peerless Rock Co. Coal was strip mined by Markley Coal Co.

Okfuskee.—Petroleum and natural gas were produced from numerous fields. The Olympic field furnished 1.1 million barrels of oil. Natural-gas liquids were recovered by two plants of Grimes & Grimes and by the new Laffoon plant of Kerr-McGee Oil Industries, Inc. Sand and gravel was produced by the State highway department.

Oklahoma.—Petroleum and natural gas were produced from numerous fields. Oklahoma City and West Edmond fields had oil productions exceeding 3 million and 1 million barrels, respectively. Natural-gas liquids were recovered by Patton & Swab, Inc., Champlin Oil & Refining Co., Phillips Petroleum Co. (three plants), and Cities Service Oil Co. The Oklahoma City plant of Monarch Refineries, Inc., was inactive during the year. Clay for manufacturing brick and tile was obtained from pits in the western part of Oklahoma City by Acme Brick Co. and United Brick & Tile Co. Near Choctaw, clay for lightweight aggregate was produced by Oklahoma Lightweight Aggregate Corp. Structural and paving sand was produced by four operators and paving sand by the State highway department.

Okmulgee.—Coal was mined underground near Henryetta by Ben Hur Coal Co. Petroleum and natural gas were produced from numerous fields. Phillips Petroleum Co. refinery at Okmulgee was in operation. Paving sand was produced for highways. Sandstone was quarried near Henryetta by the Ada Stone Co.

Osage.—Osage had many fields producing oil and gas and was the leading oil-producing county. The Burbank field, under an extensive waterflooding program, produced 14.5 million barrels of oil and remained the most prolific. Natural-gas liquids were recovered by Phillips Petroleum Co. (two plants); The Neal Gasoline Co. plant was to be salvaged. Crushed limestone was produced by Burbank Rock Co., Mervine Stone Co., and Cookson Stone Co. (two quarries). Sand was produced by various operators.

Ottawa.—All of Oklahoma's lead and zinc output and a major part of the Tri-State District output was supplied from mines in Ottawa County. Because of depressed metal markets, all major mining operations remained closed during the year. At Miami, Rare Metals plant of The Eagle-Picher Co. and Winart Pottery operated during the year. Chat, a byproduct of zinc and lead milling, was supplied by five producers. Tripoli was quarried in east-central Ottawa County by American Tripoli Division and processed in its plant at Seneca, Mo. Mineral specimens of sphalerite and galena were collected and sold as gem stones.

Pawnee.—Petroleum and natural gas were produced from numerous fields; natural-gas liquids were recovered by Frame Natural Gasoline Co. Construction and paving sand and gravel were produced by two operators and the State highway department. Crushed limestone was produced at the Ralston quarry by Cookson Stone Co. and by various other producers.

Payne.—Petroleum and natural gas were produced from numerous fields. Yale-Quay had a production of 1.7 million barrels of oil and was the largest producer in the county. Natural-gas liquids were recovered by the plant of Boswell-Frates Co. At Cushing, refineries of Kerr-McGee Oil Industries, Inc., and of Midland Cooperatives, Inc., operated throughout the year. Crushed limestone was produced by Cookson Stone Co. at the Cushing quarry, and sand by the Payne County highway department.

Pittsburg.—Pittsburg County ranked fourth in value of coal produced. Coal was mined underground by Lone Star Steel Co. at Carbon No. 5 mine. Natural gas was produced from three fields near Quinton. Sand was produced for highway construction. Clay for manufacturing brick and tile was produced by the Oklahoma State Penitentiary west of McAlester.

Pontotoc.—Petroleum and natural gas were produced from many fields, and natural-gas liquids were recovered by plants of Humble Oil & Refining Co. and Kerr-McGee Oil industries, Inc. Building limestone was quarried near Fittstown by Townsend Quarry. Shale and limestone were quarried near Lawrence by Ideal Cement Co. for use in its Ada plant. Mid-Continent Glass Sand Co. produced glass sand and molding sand. Paving sand and gravel was produced by the State highway department. At Ada, Okla., Ideal Cement Co.

operated its new $20 million plant, which includes a 12- by 450-foot kiln, and put its old plant on standby status.

Pottawatomie.—Petroleum and natural gas were produced from numerous fields. St. Louis field was the largest producer. Natural-gas liquids were recovered by the plants of Warren Petroleum Co. and Sinclair Oil & Gas Co. Paving gravel for highways was produced by the State highway department, and construction sand by two producers.

Rogers.—The county ranked first in coal production. Coal was strip mined by McNabb Coal Co. and Peabody Coal Co. Clay and shale were produced by Chandler Materials Co. Petroleum and natural gas were produced from three fields. The Chelsea district produced most of the oil. The U.S. Army Corps of Engineers, Tulsa District, announced that 105 oil wells below the elevation of 651 feet on 430 acres just south of the Rogers County line would be the first to be plugged before the Oologah basin is inundated in a waterflooding project.

Seminole.—Petroleum and natural gas were produced from numerous fields. Seminole City field was the most prolific. Natural-gas liquids were recovered by plants of Redco Corp., Sinclair Oil & Gas Co., and Phillips Petroleum Co. Clay for manufacturing brick and tile was obtained west of Wewoka by Wewoka Brick & Tile Co. Sand and gravel was produced for highways.

Sequoyah.—The county ranked fifth in value of coal. Coal was strip mined by Sallisaw Stripping Co. Limestone was mined and crushed north of Marble City at the quarry of the St. Clair Lime Co. Part of this limestone was burned at Sallisaw in the kilns of the St. Clair Lime Co.; the remainder was used as agricultural lime and for highways. Other quarrymen produced limestone for riprap. Natural gas was produced from a small field.

Stephens.—The county was second in petroleum production and also produced considerable natural gas. Natural-gas liquids were recovered by four plants. D-X Sunray refinery at Duncan operated throughout the year. Crushed sandstone and paving gravel were produced for highways.

Texas.—Natural gas from the vast Hugoton gasfield and petroleum were produced during the year. Natural-gas liquids were recovered in the vicinity of Guymon by Cities Service Oil Co. and Hugoton Plains Gas & Oil Co. and elsewhere by Dorchester Corp. and Excelsior Corp. Construction sand and gravel was produced by three operators.

Tillman.—Petroleum and a small quantity of natural gas were produced. The Grandfield refinery of Bell Oil & Gas Co. operated all year. Construction sand was produced by two operators. Century Granite Co. operated a granite-finishing plant at Frederick.

Tulsa.—Petroleum and natural gas were produced. In Tulsa, brick and tile were manufactured by Acme Brick Co. and United Brick & Tile Co.; in Collinsville by United Brick & Tile Co. East of Tulsa, near Garnett, crushed limestone was produced by Anchor Stone Co., Chandler Materials Co., and Standard Industries, Inc. Also east of Tulsa, Dewey Portland Cement Co. was building a $12 million plant to produce 1.25 million barrels of cement yearly. Construction and paving sand were produced by nine operators. At west Tulsa, refineries of The Texas Co. and of D–X Sunray operated throughout the year.

Washington.—Petroleum and natural gas were produced from five districts. Limestone and clay were quarried by Dewey Portland Cement Co. near Dewey for manufacturing portland cement. Crushed limestone also was produced near Bartlesville by Matoaka Stone Co. and by M. E. Stewart and Sons. The Bartlesville smelter of National Zinc Co. operated all year.

Washita.—Petroleum and natural gas were produced from several small fields and from part of prolific Elk City field. Sand and gravel was produced for highways. Agricultural gypsum was quarried near Colony by Agricultural Gypsum Co.

Woods.—Construction sand was produced near Waynoka by Waynoka Sand & Gravel Co. Salt was produced west of Freedom by Ezra Blackmon. Petroleum and natural gas were produced from several small fields.

Woodward.—Petroleum and natural gas were produced. Sand and gravel was produced by Klines Sand Pit and by the State highway department.

The Mineral Industry of Oregon

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Oregon Department of Geology and Mineral Industries.

By Frank B. Fulkerson,[1] Gary A. Kingston,[1] and Norman S. Petersen[1]

◆

MINERAL PRODUCTION in Oregon rose in value to $49.8 million, a new high, resulting from a $5.2 million gain in sand and gravel output. These essential commodities produced in 33 of the 36 counties in the State, were the leading products and with stone, cement, and nickel supplied most of the mineral value. Eleven other commodities were produced—mainly clays, diatomite, lime, mercury, pumice and volcanic cinder, and uranium. Cement and mercury production declined in 1959. Chromite mining ceased after a Federal purchase program ended for stockpiling this mineral.

Mineral-industry expansion in 1959 was mostly at two Albany plants, which were processing zirconium, hafnium, titanium, and other metals for the Atomic Energy Commission (AEC) and private industry.

Employment and Injuries.—Sizable increases in employment over 1958 were recorded in the State's primary metal industries, particularly smelting and refining of nonferrous metals and iron and steel foundries, according to information from Oregon Employment Department bulletins. Table 3 gives data on injuries in mining industries.

Government Programs.—One contract was active under the Office of Minerals Exploration (OME) program of the Department of the Interior. This contract (for $47,910, with government participation of 50 percent) was at the Big Muddy mercury prospect, Oregon Cinnabar Mines, Inc., Jefferson County.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Production and shipments of cement were 14 percent less than in 1958. Delayed dam-construction projects, a direct result of steel shortages caused by the nationwide steel strike, and slowdown of the Federal Interstate Highway Building Program were the principal reasons for the reduced demand. Output, as in previous years, was from three plants, one each in Baker, Clackamas, and Jackson Counties. Cement produced in Oregon was shipped chiefly to destinations within the State; most out-of-State shipments were made to Idaho and Washington; smaller quantities went to California and Alaska. Shipments were principally transported by truck; smaller quantities were moved by rail and boat. The ratio of bulk to container (bag) shipments was slightly lower than in 1958.

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[1] Commodity-industry analyst, Region I, Bureau of Mines, Albany, Oreg.

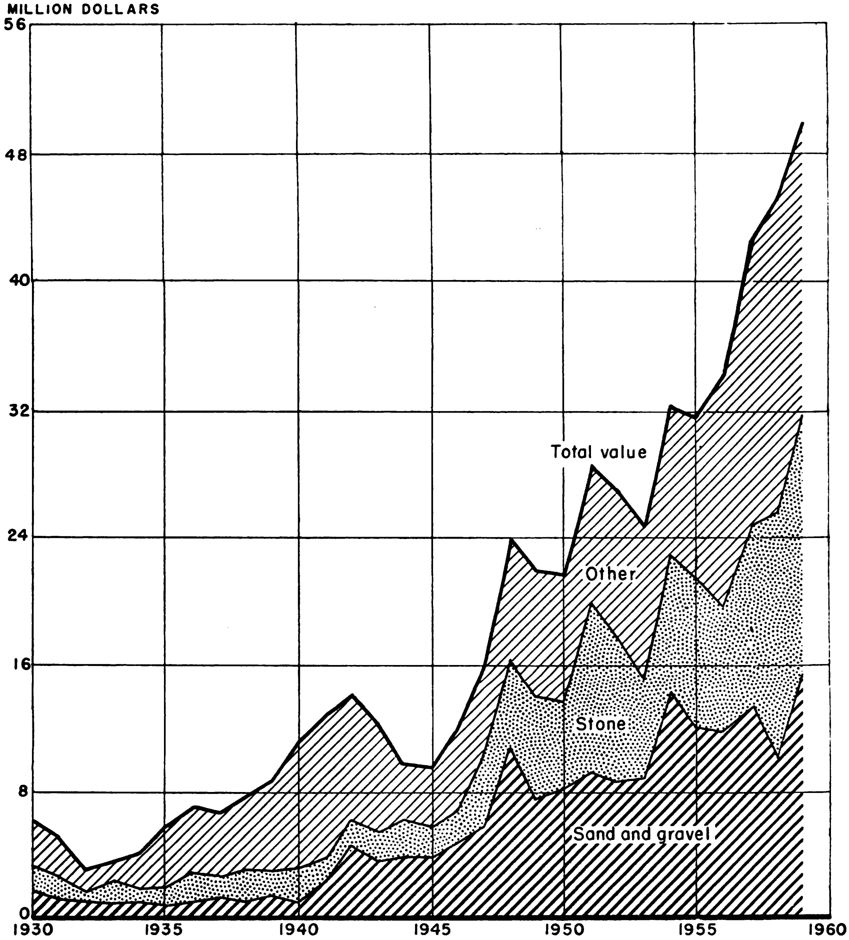

FIGURE 1.—Value of sand and gravel, stone, and total value of mineral production in Oregon, 1930–59.

Combined production from nine cement plants in Oregon and Washington was 8,081,400 barrels of finished portland cement; the same plants shipped 7,819,000 barrels during the year. Average value of portland cement shipped by producers in Oregon and Washington was $3.50 per barrel, f.o.b. mill, compared with $3.55 in 1958.

Clays and Shale.—Clays sold or used by producers advanced 17 percent, compared with 1958. Miscellaneous clay output used in making heavy clay products (principally brick and draintile) was 19 percent greater than in 1958. Miscellaneous clay was produced in Benton, Clackamas, Klamath, Malheur, Marion, Multnomah, Polk, Tillamook, Union, Washington, and Yamhill Counties. Clay and shale used at cement plants were produced in Baker and Jackson Counties. Output for this use declined 3 percent compared with 1958.

TABLE 1.—Mineral production in Oregon[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Chromite....gross weight..	4,133	(2)	----	----
Clays....thousand short tons..	252	$293	294	$308
Copper (recoverable content of ores, etc.)....	10	5	----	----
Gold (recoverable content of ores, etc.)....troy ounces..	1,423	50	686	24
Lead (recoverable content of ores, etc.)....	1	(3)	----	----
Mercury....76-pound flasks..	2,276	521	1,224	278
Nickel (content of ore and concentrate)....	12,697	(2)	12,374	(2)
Pumice....thousand short tons..	138	331	(2)	(2)
Sand and gravel....do....	10,464	10,265	18,087	15,506
Silver (recoverable content of ores, etc.)...troy ounces..	2,728	2	242	(2)
Stone....thousand short tons..	[4] 15,077	[4] 15,621	13,341	16,126
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, gem stones, iron ore (pigment material) 1959, lime, uranium (1959), and values indicated by footnote 2....	----	19,311	----	18,596
Total[5]....	----	[4] 45,190	----	49,831

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Less than $500.
[4] Revised figure.
[5] Total adjusted to eliminate duplicating value of clays and stone.

TABLE 2.—Employment and payrolls in mineral-industry establishments subject to Oregon unemployment-compensation law, by industry[1]

Industry	1958		1959	
	Employment	Payrolls (thousands)	Employment	Payrolls (thousands)
Mining....	1,330	$7,381	1,227	$6,955
Stone, clay, and glass products:				
Glass and pottery....	291	1,694	282	1,783
Hydraulic cement....	480	2,712	454	2,761
Structural clay products....	204	1,028	210	1,051
Concrete, gypsum, and plaster products....	1,344	6,827	1,451	7,917
Cut-stone and stone products....	48	256	36	209
Miscellaneous....	133	623	119	620
Total....	2,500	13,140	2,552	14,341
Primary metals:				
Blast furnaces, steelworks, rolling and finishing mills....	955	6,572	1,123	8,357
Smelting and refining of nonferrous metals.	1,792	11,319	2,046	12,546
Iron and steel foundries....	1,824	10,488	2,035	12,140
Nonferrous foundries....	235	1,160	228	1,194
Miscellaneous....	217	1,276	218	1,349
Total....	5,023	30,814	5,650	35,586
Industrial chemicals....	416	2,329	437	2,683
Products of petroleum and coal....	320	1,760	325	1,866
Grand total....	9,589	55,424	10,191	61,431

[1] Prepared from data supplied by Oregon Employment Department. Industries may vary from those in the Bureau of Mines canvass.

TABLE 3.—Injury experience in the mineral industries

	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
1958						
Quarries and mills [1]	1,023	102	832,404	2	80	98
Nonmetal mines and mills	202	210	339,720	1	9	29
Sand and gravel operations	638	199	1,017,552		27	26
Metal mines and mills	307	148	363,505		12	33
Coal mines	6	59	2,832			
Total	2,176	147	2,556,013	3	128	50
1959 [2]						
Quarries and mills [1]	915	212	1,553,713		79	51
Nonmetal mines and mills	227	238	431,625		10	23
Sand and gravel operations	727	210	1,219,362		13	11
Metal mines and mills	360	147	423,811	1	17	42
Coal mines	7	41	2,313		1	432
Total	2,236	203	3,630,824	1	120	33

[1] Includes cement- and lime-processing plants.
[2] Preliminary figures.

Shale produced for making expanded aggregate increased sharply. Raw shale mined at nearby deposits was expanded at plants of Smithwick Concrete Products Co. and Northwest Aggregate, Inc., in Washington County. The expanded product was used chiefly as lightweight aggregate for precast- and poured-concrete products.

Central Oregon Bentonite Co. began producing bentonite at Prineville, Crook County, during the year. Output was used mainly to seal earth-lined irrigation canals and reservoirs. A small tonnage was used as a binder for pelletized livestock feed.

Diatomite.—Production and shipments of prepared diatomite were 4 percent greater than in 1958. Output was from the quarry and plant of Great Lakes Carbon Corp., Mining & Mineral Products Division, near Terrebonne in northern Deschutes County. The prepared product was marketed for filter, filler, insulation, and miscellaneous applications, such as absorbents, abrasives, polishes, anticaking agent for chemical fertilizers, and as a carrier in insecticides and fungicides.

Lime.—Production of lime at the Baker plant of Chemical Lime Co. advanced 5 percent over 1958. Strikes at Pacific Northwest metallurgical and electroprocess industries, which resulted in curtailed markets for lime, resulted in shutdown of lime production facilities from mid-August to November. Yet, increased tonnages of quicklime were produced and shipped to metallurgical, electroprocess, and paper plants throughout the Pacific Northwest. Limestone was supplied from the company Marble Creek quarry northwest of Baker.

Perlite.—Output of expanded perlite by Supreme Perlite Co., Portland, Multnomah County, was down 4 percent from 1958. Nevada mines supplied the crude perlite processed at the Portland plant. Over 90 percent of the expanded product was marketed for building plaster aggregate; the remainder was for concrete aggregate and soil conditioning.

Pumice and Volcanic Cinder.—The quantity of pumice and pumiceous materials sold or used by producers in Oregon was slightly less than in the previous year. Output was from three operations in Deschutes County and one in Harney County.

Pumice output (excluding cinder and scoria) was 7 percent greater than in 1958; volcanic cinder and scoria production was 19 percent less. The greatest use of pumice was for lightweight-concrete aggregate; smaller quantities were used for insulation and road material. Cinder and scoria output was used mainly for surfacing roads; other uses included concrete aggregate, insulation, and roofing granules.

Sand and Gravel.—Total output of sand and gravel advanced to 18.1 million tons, compared with 10.5 million in 1958. The sharp rise in production (73 percent) was chiefly due to large tonnages of fill material used at U.S. Army Corps of Engineers dam-construction projects in the State. The quantity of sand and gravel used at State highway construction projects was 1 million tons more than in 1958. Sand and gravel output by commercial producers was 7.2 million tons, 14 percent greater than in 1958. Noncommercial (Government-and-contractor) output was more than double the 1958 rate, largely resulting from expanded use of pit-run material by the U.S. Army Corps of Engineers at dam-construction projects in Lane County. Production of sand and gravel was reported from 33 counties. Output exceeding 1 million tons was reported from Clackamas, Lane, Linn, and Multnomah Counties.

Stone.—Total output of stone for all purposes was 12 percent less than in 1958. The decline was caused by a sharp decrease in the quantity of crushed stone used at State highway department and U.S. Army Corps of Engineers projects. Crushed stone used for road construction and maintenance was 9 million tons, compared with 11.8 million tons in 1958. The decline was largely due to a 2.5-million-ton drop in roadstone requirements of the State highway department. Smaller tonnages of crushed stone for road use by the Corps of Engineers also contributed to the decline. Basalt was the principal stone quarried; it was used chiefly for roadstone, riprap, and ballast purposes.

Limestone output of 1.1 million tons was 8 percent less than in 1958 because smaller quantities of stone were quarried for cement use. In order of tonnages, producers reported that output was used for cement, sugar, lime, paper, calcium carbide, agricultural, metallurgical (flux), and glass purposes and/or manufacturing. Limestone was quarried in Baker, Josephine, and Wallowa Counties.

In September, Oregon Portland Cement Co. acquired the limestone quarry and processing facilities of National Industrial Products Corp. near Durkee, Baker County. The quarry, which was brought into production in 1954, has supplied limestone to Pacific Northwest sugar, paper, cement, and metallurgical plants, and for agricultural uses.

Industrial silica production was continued by Bristol Silica Co., Rogue River, Jackson County. Output, marketed for manufacturing ferrosilicon, abrasives, and refractories, was increased sharply over 1958. Work was continued on evaluating and developing the Rannells silica deposit at Quartz Mountain northeast of Tiller, Douglas County. Stone production was reported from operations in all 36

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

Use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Building	1,905	$2,385	2,360	$2,829
Concrete and roadstone	3,467	4,133	4,369	4,657
Railroad ballast	77	97	(1)	(1)
Other [2]	846	608	484	401
Total	6,294	7,224	7,213	7,887
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	23	43	5,284	2,031
Concrete and roadstone	4,146	2,998	5,589	5,588
Total	4,169	3,041	10,873	7,620
TOTAL ALL OPERATIONS				
Building	1,928	2,429	7,644	4,861
Concrete and roadstone	7,612	7,131	9,958	10,245
Railroad ballast	77	97	(1)	(1)
Other [2]	846	608	484	401
Grand total [3]	10,464	10,265	18,087	15,506

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Includes molding, engine, and ballast sands and sand and gravel used for miscellaneous unspecified purposes.
[3] Owing to rounding, the individual items may not add to total shown.

counties. Output exceeding 1 million tons was reported from Lane, Jackson, and Baker Counties.

Talc and Soapstone.—Soapstone obtained from producers in Skagit County, Wash., was ground at two plants in North Portland, Multnomah County. Output of ground soapstone, used as a carrier in insecticides, declined 4 percent from 1958.

Vermiculite (Exfoliated).—Crude vermiculite mined in Montana and South Africa was expanded at two plants in Portland, Multnomah County. Production was 4 percent less than in the previous year. The expanded product was marketed as a loose-fill insulation, as a lightweight aggregate for plaster and concrete, and as a soil conditioner.

TABLE 5.—Stone sold or used by producers, by uses

Use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
Building (dimension stone)	4	$113	(1)	(1)
Concrete, roadstone, and screening	[2] 11,793	[2] 12,380	9,018	$11,860
Riprap	1,921	1,323	2,855	2,161
Railroad ballast	(1)	(1)	(1)	(1)
Other [3]	1,359	1,806	1,468	2,105
Total [4]	[2] 15,077	[2] 15,621	13,341	16,126

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Revised figure.
[3] Used at sugar refineries, in manufacturing paper and cement, in metallurgical and chemical plants, and for other unspecified purposes.
[4] Owing to rounding, the individual items may not add to total shown.

METALS

Aluminum.—Harvey Aluminum, Inc., aluminum reduction plant at The Dalles completed its first full year of operation. Aluminum pigs, ingots, and billets, smelted from aluminum oxide imported from Japan, were shipped from the plant to fabricators in various areas, mainly to company facilities at Torrance, Calif. Similarly, the Troutdale aluminum plant of Reynolds Metals Co. marketed aluminum produced from alumina shipped into the State. Production for the State was higher than in 1958.

Railroad shipments of aluminum bar, ingot, pig, and slab originating on Class-I roads within the State of Oregon totaled 113,442 short tons, compared with 103,707 tons in 1958. Alumina terminating on Class-I roads in the State amounted to 287,869 tons, a 39-percent increase over the previous year.

Harvey Aluminum, Inc., resumed investigation of bauxitic laterite deposits near Salem in the summer. The deposits were considered to be potential sources of raw material for aluminum if technologic and economic developments permit. Research conducted at the Albany Metallurgy Research Center, Federal Bureau of Mines, indicated the possibility of processing the Salem-area material to recover alumina, low-phosphorus iron, and titanium dioxide. The method being investigated involved calcining and double leaching with caustic, yielding 82 to 87 percent alumina.

Chromium.—No chromium ore or concentrate was produced in the State in 1959, and there was little other activity concerning this commodity. Chromite mines and mills were closed in mid-1958 upon completion of the Federal chromite stockpiling program. Beneficiation tests were being conducted by the Federal Bureau of Mines on a test lot of offgrade ore from the John Day district.

Copper.—There was no reported output of copper in Oregon during the year. Work at the Standard mine (Grant County), source of most of the small quantities recovered previously, was confined to exploration and development. Similar activity, with plans for beginning open-pit mining, was indicated for Bolivar Copper Co. near Powers (Coos County) in the southwestern part of the State.

Ferroalloys.—Union Carbide Metals Co., Portland, produced ferrosilicon, silicomanganese, and ferromanganese, from manganese ore and silica shipped from other Pacific Northwest States. The plant was closed during most of the latter half of the year owing to a labor dispute coinciding with a nationwide steel strike.

National Metallurgical Co., Springfield, producer of silicon metal, was to be included in a proposed sale of the parent company, Apex Smelting Co., to Canadian Aluminum Co., Ltd. Facilities were expanded at the Springfield plant during the year.

Gold.—Oregon gold output dropped to an alltime low of 686 ounces. Of the total, about 70 percent was recovered by 27 placer operations in Baker, Coos, Douglas, Grant, Jackson, Josephine, Malheur, and Union Counties, from approximately 58,000 cubic yards of alluvium (about 0.008 ounces or 28 cents per cubic yard). Lode gold was mined principally from Jackson County mines in the Gold Hill district, with lesser quantities recovered at operations in Baker and Josephine Counties. The Boaz Mining Co. Buffalo mine, which had yielded most of the lode gold in the years just preceding, reported no production; however, work was being done to intersect ore at a lower level.

An account of early-day mining camps, principally in Baker and Grant Counties, was published in two articles.[2]

Iron and Steel.—Oregon Steel Mills, Portland, rolled steel products at near capacity throughout the year. Steel was produced from scrap remelted in three electric-arc furnaces.

Shipments of manufactured iron and steel rose 35 percent over 1958 to nearly 75,000 tons, according to Oregon State Public Utility Commission statistics of railroad freight originations on Class-I roads. Rail terminations of manufactured iron and steel were 246,200 tons, an 11-percent increase over 1958.

Zidell Machinery & Supply Co. continued to scrap surplus Government ships at a Portland yard fronting the Willamette River. The scrap market was generally slow, owing to the steel strike and few export shipments to Japan.

Lead.—No lead production was reported. Most of the small tonnage recovered in previous years was from the Buffalo gold mine, Grant County, which was nonproductive during the year.

Mercury.—The larger mercury mines, Bretz (Arentz Mining Venture), Malheur County, and Bonanza (Bonanza Oil & Mine Corp.),

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces	Value (thousands)
1950–54 (average)	17	29	2,163	7,900	$277	10,083	$9
1955	19	21	3,835	1,708	60	8,815	8
1956	15	15	1,991	2,738	96	13,542	12
1957	25	17	2,594	3,381	118	15,924	14
1958	17	33	1,947	1,423	50	2,728	2
1959	10	27	356	686	24	242	(3)
1852–1959	----------	----------	(4)	5,791,000	130,641	5,373,000	4,928

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	9	$4	6	$2	5	$1	$293
1955	4	3	3	1	----------	----------	72
1956	7	6	5	2	----------	----------	116
1957	23	14	5	1	----------	----------	148
1958	10	5	1	(3)	----------	----------	58
1959	----------	----------	----------	----------	----------	----------	24
1852–1959	12,468	4,705	823	99	173	23	140,397

[1] Includes recoverable metal content of gravel washed (placer operations), old tailings re-treated, ore milled, and ore shipped to smelters during calendar year indicated. Owing to rounding, individual items may not add to total shown.
[2] Does not include gravel washed.
[3] Less than $500.
[4] Figure not available.

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[2] Wagner, Norman S., Mining in Baker County, 1861 to 1959: Oregon Dept. of Geol. and Min. Ind., The Ore.-Bin, vol. 21, No. 3, March 1959. Rand, Helen B., Gold and Oregon's Settlement: Oregon Dept. of Geol. and Min. Ind., The Ore.-Bin, vol. 21, No. 5, May 1959.

TABLE 7.—Gold produced at placer mines

Year	Mechanical and hydraulic methods			Small-scale hand methods [1]			Total		
	Number	Material treated (thousand cubic yards)	Gold (troy ounces)	Number	Material treated (thousand cubic yards)	Gold (troy ounces)	Number	Material treated (thousand cubic yards)	Gold (troy ounces)
1950–54 (average)	18	2,452	6,507	9	10	166	27	2,462	6,673
1955	8	24	125	13	9	78	21	33	203
1956	10	52	314	5	3	40	15	55	354
1957	10	34	126	8	7	53	18	41	179
1958	24	258	489	9	6	56	33	264	545
1959	[2] 19	54	396	8	4	54	27	58	450

[1] Includes surface and underground (drift) placers.
[2] Includes 16 hydraulic mines, 2 nonfloating-washing plants. and 1 suction dredge.

Douglas County, yielded much smaller quantities of mercury than in 1958. Production for the State in 1959 was 1,224 flasks, a 46-percent decline. The Bonanza mine yielded 59 percent and the Bretz 39 percent of the total. Western Minerals, Inc., Angel Peak mine, Lake County, and Werdenhoff Mining Co., Mother Lode mine, Crook County, accounted for the remaining 2 percent. The approximate 28,000 tons of ore processed had a 0.16 percent recoverable mercury content. Of this total, 62 percent was beneficiated by flotation before furnacing.

Nickel.—Hanna Mining Co. extracted 819,500 tons of nickel ore, averaging 1.5 percent nickel, from a multiple-bench mining operation at the top of Nickel Mountain near Riddle. Ore was delivered downslope to the Hanna Nickel Smelting Co. plant for reduction to ferronickel. Production at the smelter was 10,397 tons of nickel contained in ferronickel (40–45 percent nickel).

Silver.—Like gold, silver output fell to an alltime low of 242 ounces. Sixty percent of the total was recovered from gold ore mined by Bourne Mines near Sumpter; the balance came from various other small lode and placer operations.

Uranium.—The Lakeview Mining Co. White King mine, Lake County, contributed substantially to the total value of minerals pro-

TABLE 8.—Mine production of gold and silver in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)
Lode ore:				
Dry gold:				
Ore	9	354	235	180
Old tailings	1	2	1	----------
Total lode	10	356	236	180
Gravel (placer operations)	27	(1)	450	62
Grand total	37	356	686	242

[1] 57,845 cubic yards of placer gravel washed.

duced. Company milling facilities were completed late in November 1958, following more than 3 years of exploration and development of the deposit. Initially, ore was developed and mined from underground workings; however, the operation was switched to surface mining early in 1959 because ground conditions increased costs and slowed mining. Difficulty was being experienced toward the end of the year in meeting ore-grade requirements.

Geology of the Lakeview uranium area was the subject of a report.[3]

Other Metals.—Expansion of refractory-metals processing facilities continued at the plants of Oregon Metallurgical Corp. and Wah Chang Corp. at Albany. Output from the two plants consisted of ingots and castings of columbium, tantalum, molybdenum, tungsten, titanium, vanadium, hafnium, and zirconium, as well as various alloys. In addition, Wah Chang Corp. produced zirconium and hafnium sponge metal under Government contract. The Wah Chang firm installed two electron-beam melting furnaces during the year to facilitate production of high-purity ingots. The company also was installing rolling-mill equipment that would make it the only fully integrated plant in the country capable of processing refractory metal from ore to finished product. Oregon Metallurgical Corp. made equipment modifications and installed new facilities to meet shifting demands for various new metals. Included was equipment for producing high-purity vanadium in commercial quantities and a vertical-axis, vacuum-arc, centrifugal-casting furnace for greater capacity and better quality titanium castings. Emphasis also was placed on output of tungsten-base alloys for use in the Government missile program.

MINERAL FUELS

Carbon Dioxide.—Recovery of natural carbon dioxide from mineral water pumped at wells of the Gas-Ice Corp., Ashland, Jackson County, dropped sharply from 1958. An estimated 12.4 million cubic feet of carbon dioxide was processed to dry ice at the company Ashland facilities.

Natural sources of carbon dioxide in the State were reviewed in a publication.[4]

Petroleum.—The Oregon Department of Geology and Mineral Industries issued three new drilling permits—two in Polk and one in Lincoln County—compared with four permits in 1958. In addition, work on deepening a well previously drilled in Polk County was continued during the first quarter of the year; the well was abandoned in July after reaching a depth of 1,835 feet. A total of 5,192 feet was drilled, compared with 18,060 feet drilled in 1958.

The Humble Oil & Refining Co. leased for exploration 250,000 acres of land in southern Lake County. The company did no drilling on the new leases during the year.

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[3] Peterson, Norman V., Preliminary Geology of the Lakeview Uranium Area, Oregon: Oregon Dept. of Geol. and Min. Ind., The Ore.-Bin, vol. 21, No. 2, February 1959, pp. 11–16.

[4] Wagner, Norman S., Natural Sources of Carbon Dioxide in Oregon: Oregon Dept. of Geol. and Min. Ind., The Ore.-Bin, vol. 20, No. 11, November 1959, pp. 103–113.

REVIEW BY COUNTIES

Baker.—Lower output of cement, clays, and sand and gravel, which was not offset by expanded production of lime and stone, resulted in a 14-percent decline in value of mineral production. Reduced output of cement at the Lime plant of Oregon Portland Cement Co. was the principal cause of the decline. Limestone was supplied from the nearby company-owned Limerock quarry.

Chemical Lime Co. continued to produce quicklime at a plant north of Baker; the company-operated Marble Creek quarry northwest of Baker was the limestone source.

Limestone for industrial and agricultural uses was quarried near Durkee by National Industrial Products Co. In September, the quarry, processing plant, and equipment were acquired by Oregon Portland Cement Co.

Output of crushed stone was greater in 1959, owing to increased roadstone requirements by the State highway department. Dimension granite was quarried near Haines by Northwestern Granite Co. at about the 1958 rate.

Manganese deposits in the county were the subject of a Bureau of Mines Report of Investigations.[5]

Clackamas.—Value of mineral output (cement, sand and gravel, stone and clays) ranked the county first in the State. Production of cement at the Oswego plant of Oregon Portland Cement Co. continued as the principal mineral industry activity in the county. Production and shipments of portland cement from this facility were moderately lower than in 1958. Sand and gravel and crushed stone output declined. Clays produced near Molalla and Hubbard were used to make building brick and draintile at three structural-clay plants in the county.

Columbia.—Stone, sand and gravel, and iron oxide pigment material were produced by mineral industries in the county. C. K. Williams & Co., Western Division, mined a quantity of crude iron oxide pigment from a pit near Scappoose. The crude ore was shipped to the company Emeryville, Calif., paint-manufacturing plant, where it was processed to paint pigment.

Crook.—Bentonite was mined at a new operation near Prineville by Central Oregon Bentonite Co. Output was used mainly as a hydroseal; some was used as a bond for pelletized stockfood. Sand and gravel and crushed stone were produced also.

Deschutes.—Mineral industries in the county produced diatomite, pumice, sand and gravel, and stone. Diatomite, mined and processed by Great Lakes Carbon Corp., Mining & Mineral Products Division, in terms of value, continued as the principal mineral commodity produced in the county. The county also was a principal source of pumice and volcanic cinder. Production of pumice materials by three producers was substantially the same as in 1958.

Douglas.—Hanna Mining Co. and Hanna Nickel Smelting Co. operated at capacity as in 1958. Smelter production of ferronickel was delivered under contract to the national stockpile.

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[5] Appling, Richard N., Jr., Manganese Deposits of Northeastern Oregon: Bureau of Mines Rept. of Investigations 5472, 1959, 28 pp.

TABLE 9.—Value of mineral production in Oregon, by counties

[Thousand dollars]

County	1958	1959	Minerals produced in 1959 in order of value
Baker	(1)	(1)	Cement, stone, lime, sand and gravel, clays, gold, silver.
Benton	$181	$471	Sand and gravel, stone, clays.
Clackamas	8,732	(1)	Cement, sand and gravel, stone, clays.
Clatsop	115	141	Stone, sand and gravel.
Columbia	194	252	Stone, sand and gravel, iron ore (pigment material).
Coos	564	292	Stone, sand and gravel, gold.
Crook	272	252	Sand and gravel, stone, clays, mercury.
Curry	106	251	Stone, sand and gravel.
Deschutes	1,100	1,210	Diatomite, pumice, stone, sand and gravel.
Douglas	6,830	6,576	Nickel, sand and gravel, stone, mercury, gold, silver.
Gilliam	299	75	Stone.
Grant	413	84	Stone, sand and gravel, gold, silver.
Harney	75	112	Stone, pumice.
Hood River	64	197	Stone, sand and gravel.
Jackson	3,129	4,185	Cement, stone, sand and gravel, clays, gold, carbon dioxide, silver.
Jefferson	166	87	Stone, sand and gravel.
Josephine	826	763	Sand and gravel, stone, gold, silver.
Klamath	515	240	Stone, sand and gravel, clays.
Lake	194	(1)	Uranium, sand and gravel, mercury, stone.
Lane	3,663	5,427	Sand and gravel, stone.
Lincoln	672	439	Stone, sand and gravel.
Linn	514	2,563	Sand and gravel, stone.
Malheur	846	1,008	Sand and gravel, stone, mercury, clays, gold, silver.
Marion	1,058	382	Sand and gravel, stone, clays.
Morrow	247	188	Stone.
Multnomah	2,657	3,411	Sand and gravel, stone, clays.
Polk	629	475	Do.
Sherman	159	345	Stone, sand and gravel.
Tillamook	324	175	Stone, sand and gravel, clays.
Umatilla	1,013	1,059	Stone, sand and gravel.
Union	448	663	Stone, sand and gravel, clays, gold.
Wallowa	243	138	Stone, sand and gravel.
Wasco	509	815	Do.
Washington	985	777	Stone, clays, sand and gravel.
Wheeler	206	188	Stone, sand and gravel.
Yamhill	263	198	Sand and gravel, stone, clays.
Undistributed [2]	8,189	17,399	
Total [3]	45,190	49,831	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1.

[3] Total adjusted to eliminate duplicating value of clays and stone—1958 total revised.

Bonanza Oil & Mine Corp. continued mercury mining at the Bonanza mine near Sutherlin. Furnace ore totaled 9,855 tons; it had an approximate mercury content of 0.278 percent.

Development was continued at the Rannells silica deposit on Quartz Mountain.

Harney.—Crude and prepared pumice was produced by Harney Concrete Tile Co. at an operation near Burns. The crude pumice was marketed for road-surfacing material and the prepared product was used as lightweight-concrete aggregate. Output of both crude and prepared pumice was less than in 1958.

Jackson.—Ideal Cement Co. continued production of cement at Gold Hill; output was moderately greater than in 1958. Limestone used at the plant was obtained from a quarry in Josephine County; shale was supplied from the company Gold Hill shale quarry. Bristol Silica Co. quarried and crushed silica for industrial uses at an operation near Rogue River; the firm also quarried and crushed granite, which was marketed for poultry grit. Natural carbon dioxide used in manufacturing dry ice was recovered from mineral waters by Gas-Ice Corp. near Ashland. Output of crushed stone in the county was more than three times as much as in 1958 owing to increased stone requirements by the Bureau of Reclamation (riprap), county road department (roadstone), and U.S. Forest Service (roadstone). Production of sand and gravel declined 4 percent.

Josephine.—Ideal Cement Co. operated the Marble Mountain quarry to supply limestone for use at the company cement plant at Gold Hill, Jackson County. Production at the quarry was moderately greater than in 1958. Output of sand and gravel was six times more than in 1958, chiefly the result of increased road-gravel use by the U.S. Forest Service and the State highway department. Curtailed use of crushed stone at State highway projects caused a sharp reduction in the quantity of stone produced.

Lane.—The county ranked first in production of sand and gravel (6.6 million tons) and of stone (2.3 million tons). In 1958, 1.2 million tons of sand and gravel and 3.9 million tons of stone were produced at operations in the county. The large increase in sand and gravel output was entirely due to requirements at U.S. Army Corps of Engineers works. The major portion of the increase was lower-value pit-run material. Stone output dropped sharply as a result of decreased requirements by the Corps of Engineers.

Linn.—Oregon Metallurgical Corp. and Wah Chang Corp., Albany, continued to produce ingots and castings of columbium, tantalum, molybdenum, tungsten, titanium, vanadium, hafnium, and zirconium.

At the Bureau of Mines metallurgical-research center, also at Albany, the program of laboratory investigations was highlighted by achieving the first shaped casting of molybdenum and the first ductile yttrium.

Malheur.—The Bretz mine (Arentz Mining Venture) near McDermitt yielded 480 flasks of mercury from 17,287 tons of ore, beneficiated by flotation to produce a concentrate for furnacing.

Multnomah.—Chemical and metallurgical plants in Portland continued to produce calcium carbide, ferrosilicon, ferromanganese, silicomanganese, caustic soda, chlorine, and rolled-and cast-steel products. Portland was the port of entry for foreign base-metal ores and concentrates transshipped to smelters in Idaho and Montana. Also, aluminum oxide from Japan was received at the port for reduction to aluminum at the Harvey Aluminum, Inc., plant at The Dalles. A new 3-year contract was signed between Reynolds Metals Co., primary aluminum producer at Troutdale, and the United Steel Workers Union, representing the Reynolds company workers.

The value of mineral production was $3.4 million, compared with $2.7 million in 1958. Sand and gravel, stone, and clays were the mineral commodities produced. Sand and gravel production rose to 3 million tons—50 percent more than in 1958. Increased commercial output accounted for a major part of the increase. Larger tonnages of road gravel used by the U.S. Army Corps of Engineers also contributed to the advance. Clay for use in making building brick was mined from a pit near Gresham by Columbia Brick Works. Output increased over 1958. In addition, perlite, vermiculite, and soapstone were received from out-of-State mines for processing at plants in the county. Crude perlite mined in Nevada was expanded to a lightweight aggregate product by Supreme Perlite Co. Soapstone produced in Washington was ground by Stauffer Chemical Co. and Miller Products Co. for use as a carrier in insecticides. Crude vermiculite was expanded to loose-fill insulation and lightweight aggregate products at two plants. Vermiculite Northwest, Inc., processed crude vermiculite mined in Montana, and Supreme Perlite Co. exfoliated crude vermiculite imported from South Africa. Natural and artificially colored roofing granules were produced at Portland by The Flintkote Co.

Polk.—Limestone was quarried at operations near Dallas by Oregon Portland Cement Co. for use at its Oswego cement plant and by Polk County Lime Co. for agricultural use. The total tonnage produced advanced moderately over 1958. Monmouth Brick & Tile Co. manufactured draintile from clay mined near Monmouth.

Wasco.—Harvey Aluminum, Inc., plant, The Dalles, was fully operative during the year, and approximately 500 workers were employed.

Washington.—Shale for processing to expanded lightweight aggregate was quarried near Vernonia and Banks. Output for this purpose increased sharply over 1958. Clay for manufacturing draintile was produced about the 1958 rate from a pit near Scholls.

The Mineral Industry of Pennsylvania

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey.

By Robert D. Thomson [1], Mary E. Otte [2], and Robert E. Ela [3]

◆

PRODUCTION of minerals in Pennsylvania in 1959 continued to decline; total value dropped $18.2 million or 2 percent below 1958. Output in 1959 was the lowest in value since 1942, primarily because of decreases of 8 percent in anthracite and in bituminous coal and 3 percent in petroleum. Increased demand for cement, clay, lime, natural gas, iron ore, sand and gravel, stone, and zinc was not enough to overcome the $44.7 million drop in the three basic fuels.

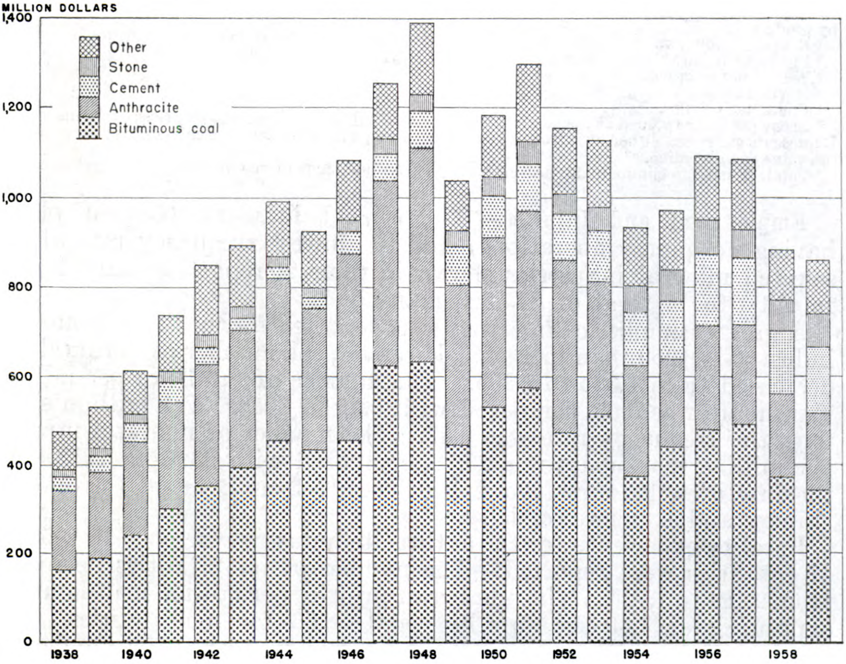

FIGURE 1.—Value of bituminous coal, anthracite, cement, and stone, and total value of mineral production in Pennsylvania, 1938–59.

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TABLE 1.—Mineral production in Pennsylvania[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Cement:				
Portland—376-pound barrels	40,147,578	$135,118	41,270,129	$143,054
Masonry—do	1,967,517	7,281	2,086,499	7,864
Clays	[2] 3,317,600	[3] 17,051	3,466,361	17,196
Coal:				
Anthracite	21,171,142	187,898	20,649,286	172,320
Bituminous	67,770,862	373,812	65,347,088	345,332
Cobalt (content of ore)—pounds	564,382	(3)	280,098	(3)
Gem stones	(4)	2	(4)	3
Lime	1,003,058	[5] 14,161	1,263,180	18,261
Natural gas—million cubic feet	95,869	27,131	[6] 108,000	[6] 30,700
Natural gas liquids:				
Natural gasoline—thousand gallons	1,608	107	2,884	184
LP-gases—do	1,363	123	1,484	36
Peat	23,623	203	26,948	262
Petroleum (crude) thousand 42-gallon barrels	6,472	26,535	[6] 6,156	[6] 25,855
Sand and gravel	11,825,024	19,180	14,257,014	23,233
Stone	40,049,162	69,694	43,681,721	77,420
Zinc[7]—short tons	10,812	2,229	16,718	3,828
Value of items that cannot be disclosed: Copper, gold, graphite (1959), iron ores (includes crude iron oxide pigments), mica, pyrites, sericite schist, silver, soapstone, tripoli, and values indicated by footnote[3]		[5] 15,960		15,812
Total Pennsylvania[8]		[5] 882,040		863,818

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes kaolin; value included with "Items that cannot be disclosed."
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Weight not recorded.
[5] Revised figure.
[6] Preliminary figure.
[7] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[8] Total adjusted to eliminate duplicating value of clays and stone in manufacturing lime and cement.

Employment and Injuries.—The cement industry (cement plants having no quarry operations) had the lowest frequency rate of the selected mineral industries shown in table 2, reporting only 1 nonfatality for a total of 845,523 man-hours.

A greater number of fatalities were reported for the bituminous-coal industry in 1959 than in 1958. However, the number of nonfatalities decreased from 1,389 to 1,205. The number of fatalities per million man-hours was 0.69, compared with 0.55 in 1958. Per million short tons, the frequency rate was 0.47. The number of nonfatal injuries per million man-hours was 23.18, compared with 23.94 in 1958. Of the fatalities, 17 were from fall of roof, 7 from haulage, 5 from machinery and 4 from electricity.

Fatality experience for the anthracite industry worsened in 1959, as 47 fatalities were reported. The number of nonfatalities decreased from 2,124 to 1,723. The number of injuries per million man-hours of exposure was 1.60 for fatalities and 58.66 for nonfatalities. The number of fatalities per million short tons was 2.29; the number of nonfatalities was 84.07. Eighteen (38 percent) of the 47 fatalities at anthracite mines in 1959 were charged to falls of face, rib, or roof. A major mine inundation was the second ranking cause of fatal injuries, with 12 fatalities (26 percent). Thirteen (72 percent) of the 18 face, rib, or roof-fall accidents were at mines employing 15 or more men underground, and 5 (28 percent) of these fatalities were at mines employing less than 15 men underground. Eleven (61 percent) of the fatalities charged to falls of face, rib, or roof occurred near the face; four (22 percent) by the face area; and three (17 percent) on gangways. Falls of roof rock accounted for 13 of the 18 roof-fall fatalities; falls of rib, 3; and falls of roof coal and face, 1 each. Fatalities from falls of face, rib, or roof, by payroll classification, were eight miners, eight laborers, one timberman, and one assistant mine foreman.

The Stockton mine of the Jeddo-Highland Coal Co. in Luzerne County was the winner of the National Safety Competition for anthracite mines in 1959. The mine was operated for 57,329 man-hours without a lost-time injury. Winners of Certificate of Achievement in Safety for anthracite mines included Loree Nos. 2, 3, 4, and 5; Boston mine; and Eddy Creek Colliery, all operated by The Hudson Coal Co. The winner of the bituminous coal group of the National Safety Competition for 1959 was the Harwick mine operated by Duquesne Light Co. in Allegheny County. This mine was worked 355,088 man-hours without a lost-time injury. The Bowman mine in Westmoreland County, operated by the Bowman Coal Co., received a Certificate of Achievement in Safety. The Bellefonte mine of the National Gypsum Co. in Centre County was awarded a Certificate of Achievement in Safety for its record in the nonmetal group. The mine was worked 212,218 man-hours without a lost-time injury. Also cited for outstanding safety achievements were the G. & W. H. Corson, Inc., Plymouth Meeting lime operation (Montgomery County) the National Gypsum Co. lime operation in York County, and the Pleasant Gap lime plant in Centre County operated by Standard Lime & Cement Co., Division of American-Marietta Co.

TABLE 2.—Employment and injuries for selected mineral industries in 1959[1]

Commodity	Average number of men working	Total man-hours	Total lost-time injuries		Injuries per million man-hours
			Fatal	Nonfatal	
Anthracite	23, 294	29, 371, 307	47	1, 723	60. 26
Bituminous coal	34, 200	51, 990, 000	36	1, 205	23. 87
Cement[2]	353	845, 523	----------	1	1. 18
Clays	2, 470	4, 780, 508	1	156	32. 84
Lime[3]	35	71, 008	----------	1	14. 08
Sand and gravel	1, 542	3, 164, 980	----------	45	14. 22
Stone	9, 299	19, 881, 182	5	333	17. 00

[1] Preliminary figures.
[2] Excludes cement operations having quarry operations.
[3] Excludes lime operations having quarry operations.

Consumption, Trade, and Markets.—Most of the mineral commodities produced in Pennsylvania were consumed in the State. Bituminous coal, the State's foremost mineral commodity, was used primarily in local powerplants, for coke production, as residential fuel, and for other industrial uses. The bulk of the anthracite was shipped outside the producing region for electric power generation, residential fuel, cokemaking, sintering and pelletizing iron ore, and railroad use. The other mineral fuels produced in Pennsylvania—petroleum, natural gas, and natural-gas liquids—were consumed within the State.

Nonmetallic minerals also were important to the economy of Pennsylvania and were largely consumed within the State. Thirty-five percent of the portland cement, 39 percent of the masonry cement, and 61 percent of the lime were consumed locally. Clay production was primarily captive tonnage for use in manufacturing refractories and heavy clay products. Stone and sand and gravel were used near the producing sites for construction and paving projects. In addition, large quantities of industrial sand, slate, and fluxing stone were produced.

Metallic ores were produced in the southeastern part of the State. However, the consuming industries, such as steel, relied chiefly on shipments of ore from other States and foreign deposits.

Legislation and Government Programs.—In 1959 five projects were approved under the Federal-State program for controlling mine water in the anthracite regions. Three projects were surface-drainage improvements, and two were pump installations, one of which was cancelled during the year. Thirteen projects had been completed since the program was initiated in 1955. Nine projects were in varying stages of construction or undergoing final tests. Ten of the projects required a total of 29 deep-well pumps with an aggregate capacity of 143,000 gallons per minute. The remaining 12 projects provided such surface-drainage improvements as backfilling old strip pits and the construction of ditches and flumes.

On January 22, 1959, the Susquehanna River, in flood stage, broke into mine workings near Wilkes-Barre. The water spread through adjacent mines and flooded workings underlying about 5 square miles of surface area. Emergency funds, made available by a disaster proclamation, were used to obtain pumping equipment from the mine-water control program and to obtain other large-capacity pumps to unwater the flooded mines. The underground pool was lowered nearly 300 feet in order to conduct recovery operations and permanently seal the breakthrough point.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Anthracite.—The output of anthracite again decreased, totaling 20.6 million short tons, a reduction of 2 percent from 1958. The decline in production in 1959 was partly due to a 500,000-ton drop in exports. Apparent consumption in the United States fell only 1 percent, as the decline in shipments of the larger sizes was almost offset by increased shipments of Buckwheat Nos. 4 and 5 and "other." The percentages contributed by the various sources changed sharply, owing to the differences in market demand for individual sizes and the mine-flood disaster in the northern field, which destroyed underground productive capacity estimated at 1.4 million tons annually.

Underground production dropped from 51 to 46 percent of the total output. Output from strip mines increased from 32 to 34 percent and culm-bank production rose from 14 to 17 percent. Dredge production represented 3 percent of the total in both years.

The same percentage of the coal produced underground was loaded by hand as in 1958; 4.7 million short tons were hand-loaded in 1959, compared with 5.4 million in 1958. A total of 4.7 million tons was loaded mechanically in 1959, compared with 5.3 million tons in 1958. In all, 186 scraper loaders (104 less than 1958), 46 mobile loaders (5 less than in 1958), and 869 conveyors and pit-car loaders (365 less than in 1958) were used to mechanically load coal underground. Production from strip pits increased 3 percent in 1959, totaling 7.1 million tons. A total of 168 power shovels and 233 draglines were used in stripping Pennsylvania anthracite and in the recovery of culm banks. This compares with 179 and 245, respectively, in 1958. Production from culm banks totaled 3.4 million tons, and by dredge 717,000 tons, increases of 18 and 4 percent, respectively. Production from culm banks came from the Lehigh, Schuylkill, and Wyoming regions and Sullivan County; the largest output came from Schuylkill region. Anthracite was recovered from the Lehigh, Schuylkill, and Susquehanna Rivers. Average value per ton for dredged anthracite increased from $1.92 to $3.22.

Apparent consumption continued to decrease, declining 200,000 tons to 18.8 million tons. A total of 15.7 million tons of anthracite was shipped outside the producing area (3 percent less than in 1958), whereas 4.8 million tons was sold to local trade and 129,000 tons was sold as colliery fuel. Overall shipments in 1959 were 2 percent less than in 1958. According to the Pennsylvania Department of Mines and Mineral Industries, 9.8 million short tons of anthracite was shipped by rail; 28 percent went to New York, 12 percent to New Jersey, and 25 percent to consumers in Pennsylvania. Truck shipments totaled 8.7 million tons; 15 percent was shipped to New York, 7 percent to New Jersey, and 76 percent to points in Pennsylvania (45 percent within the producing region and 31 percent outside the producing region). Average value per ton of anthracite was $8.53 for that shipped outside the producing regions, $7.80 for local sales, and $5.97 for colliery fuel, compared with $9.02, $8.51, and $6.33, respectively, in 1958.

The average number of men working daily totaled 23,294, 3,246 less than in 1958. The average number of days active was 173, compared with 183 in 1958. Output per man per day for all types of operations was 5.12, compared with 4.36 in 1958.

Schuylkill County's anthracite production, 7.9 million tons, continued to be the greatest in Pennsylvania. Luzerne County was the second-ranking county with a production of 6.2 million tons. Other counties producing anthracite (in order of decreasing tonnage) were Northumberland, Lackawanna, Columbia, Lancaster, Carbon, Dauphin, Snyder, Lebanon, Northampton, Sullivan, and Wayne.

Bituminous Coal.—Output from the Pennsylvania bituminous coalfields continued to decline. The number of mines in operation also decreased. Thirty-six percent less coal was produced in 1959—a drop in production of 2.4 million tons. The index of coal production dropped to 53 (1947–49=100) from 55 in 1958 and 68 in 1957.

In 1959, 1,383 mines producing 1,000 tons or more were active (29 less than in 1958). The number of active underground mines decreased from 809 to 756, strip mines increased from 565 to 589, and auger mines remained the same at 38.

Approximately 68 percent of the bituminous-coal output came from underground mines; this was 3.2 million tons less than in 1958. Of the total underground output, 43.7 million tons was cut by machines, including the proportion mined by continuous miners; the remainder was cut by hand or shot from the solid. In all, 1,314 cutting machines and 306 continuous miners were used. Locomotives (2,165), animals (526), mother conveyors (316), shuttle cars (1,126), and rope hoists (608) were used for underground haulage. Pennsylvania underground production continued to be characterized by highly mechanized operations, with 93 percent of the underground production mechanically loaded by 1,224 machines. Mobile loaders were the primary moving device, loading 14,057,000 tons into shuttle cars, 2,104,000 tons into mining cars, and 690,000 tons onto conveyor belts. Handheld and post-mounted drills as well as mobile drills were used underground; 14.5 million tons of coal was drilled with 1,185 handheld or post-mounted drills, and 5.5 million tons of coal was drilled with 125 mobile drills.

Pennsylvania output by strip mining increased approximately 600,000 tons. Bituminous coal was stripped and loaded, using electrical, diesel-electric, diesel, and gasoline power shovels and draglines. Of the 974 power shovels in use (6 more than in 1958), 914 had a capacity of less than 3 cubic yards; 57, 3 to 5 cubic yards; and 3, more than 12 cubic yards. A total of 385 draglines was used (8 more than in 1958); 153 had a capacity of less than 3 cubic yards; 143, 3 to 5 cubic yards; 82, 6 to 12 cubic yards; and 7, more than 12 cubic yards. A total of 21 carryall scrapers (3 less than in 1958) was used; 10 had a capacity of over 12 cubic yards; 5, 6 to 12 cubic yards; 3, 3 to 5 cubic yards; and 3, less than 3 cubic yards. In addition, 877 bulldozers (44 more than in 1958), 141 horizontal power drills, and 130 vertical power drills were used.

Bituminous coal produced from underground mines was shipped primarily by rail (87 percent) and truck (9 percent). A major portion of the underground production (53 percent) was captive. The average value per ton of coal produced underground was $6.01, with an average value of $5.33 for coal sold on the open market. Truck shipments of strip coal to consumers totaled 7.5 million tons, representing 37 percent of the strip-mine production. The average value per ton of strip-mine coal was $3.73, 13 cents lower than in 1958. Strip-mine coal sold on the open market was valued at $3.70 per ton and captive production was valued at $5.10.

There were 38 auger mines active in 1959. More than 61 percent of the auger-mine production was shipped by rail. Auger coal was sold at an average value of $3.19 per ton.

Eighty-five preparation plants were active, compared with 94 in 1958. These plants produced 37.4 million tons of clean coal; 89 percent came from underground mines, and 11 percent from strip mines. Of the mine production mechanically cleaned, 88 percent was wet washed (17 percent by jigs and 71 percent by other wet methods) and 12 percent was cleaned by pneumatic methods.

At the mines having crushing facilities, 28.9 million tons was crushed; this amount was 60 percent of the tonnage produced at these mines. The total output from mines having treatment facilities was 23 million tons. Of this total, 6.2 million tons was treated—708,000 tons with calcium chloride, 4 million tons with oil, 342,000 tons with both calcium chloride and oil, and slightly over 1 million tons with other materials.

Bituminous coal was produced in 28 counties in 1959. Washington County was the leading county for production from underground mines, followed by Cambria, Indiana, Westmoreland, Fayette, Armstrong, and Clearfield Counties. Clearfield County led in production from strip mines, followed by Clarion, Butler, Armstrong, Indiana, and Somerset. Armstrong led in the production of auger mines followed by Clearfield, Butler, Washington, Jefferson, Cambria, Elk, and Somerset Counties.

TABLE 3.—Bituminous-coal production, by types of mining and counties, 1959

County	Underground		Strip		Auger	
	Number of mines	Short tons	Number of mines	Short tons	Number of mines	Short tons
Allegheny	29	4,204,057	27	562,506	--------	--------
Armstrong	58	1,234,329	36	1,312,151	9	160,080
Beaver	4	18,938	24	252,465	--------	--------
Bedford	24	99,841	4	61,351	--------	--------
Blair	(1)	(1)	(1)	(1)	--------	--------
Bradford	--------	--------	1	6,798	--------	--------
Butler	28	234,917	38	1,736,035	3	37,438
Cambria	92	6,736,821	27	481,595	1	14,957
Cameron	--------	--------	1	50,887	--------	--------
Centre	17	51,112	18	670,026	1	4,263
Clarion	12	68,715	31	2,832,050	1	4,212
Clearfield	88	1,142,700	106	4,846,473	9	58,950
Clinton	4	14,788	6	623,816	--------	--------
Elk	19	158,593	7	133,890	2	14,937
Fayette	41	2,348,913	31	335,352	--------	--------
Greene	19	9,636,015	3	7,243	--------	--------
Huntingdon	9	18,073	5	44,266	--------	--------
Indiana	83	5,123,486	33	1,031,364	3	44,243
Jefferson	30	218,768	29	660,661	4	15,401
Lawrence	1	6,300	28	995,981	--------	--------
Lycoming	3	14,233	2	42,870	--------	--------
McKean	--------	--------	3	42,293	--------	--------
Mercer	3	41,143	7	488,437	--------	--------
Somerset	103	947,695	54	1,100,925	2	14,778
Tioga	(1)	(1)	(1)	(1)	--------	--------
Venango	--------	--------	13	552,260	--------	--------
Washington	(1)	(1)	21	974,903	(1)	(1)
Westmoreland	(1)	(1)	23	160,016	1	1,029
Undistributed	89	12,322,728	11	305,372	2	27,649
Total	756	44,642,165	589	20,306,986	38	397,937

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Coke and Coal Chemicals.—Pennsylvania continued to rank first in the United States in output of beehive and oven coke. Production from oven-coke operations decreased 2 percent or 213,000 short tons, primarily due to a 116-day steel strike. However, production of beehive coke was double that of 1958, totaling 713,000 tons.

Fourteen plants, operating 4,133 slot-type ovens (35 less than operated in 1958), carbonized 19.9 million short tons of coal to produce 13.8 million tons of oven coke. Yield of coke from coal was 69.19 percent. The average value of oven coke at the ovens was $16.56 per ton, compared with $16.92 in 1958. Of the oven coke produced in Pennsylvania, 92 percent was used by the producers in blast furnaces, and 4 percent was sold to consumers for use in blast furnaces. The remainder was used principally by foundries and to make producer gas and water gas.

A total of 1,141,000 tons of coal was carbonized in 6,080 beehive ovens (1,236 less than in 1958) to produce 713,000 tons of coke. Yield of coke from coal increased from 61.14 percent to 62.52 percent. The average value of beehive coke at the ovens was $14.60 a ton, compared with $13.46 in 1958. The beehive coke was sold for use in blast furnaces (79 percent of 1959 production), by foundries, for residential heating, and for other industrial uses.

Coal produced in Kentucky, Pennsylvania, Virginia, and West Virginia was used at oven-coke plants in Pennsylvania. Most of the coal (57 percent) came from mines in Pennsylvania. Seventy-six percent of the coal used at coke-oven plants was high-volatile, 9 percent medium-volatile, and 15 percent low-volatile.

A total of 210 billion cubic feet of coke-oven gas was produced in Pennsylvania; 39 percent was used in heating ovens, 60 percent was surplus used or sold, and 1 percent was wasted. Thirteen plants produced coke-oven ammonia having a yield of 194,683 short tons of sulfate equivalent. A total of 191 million gallons of coke-oven tar was produced in 1959; 109 million gallons was used by producers for refining or topping, 34 million gallons as fuel, and 42 million gallons sold for refining into tar products. Crude light oil totaling 58 million gallons was produced at 14 oven-coke plants. Plants in Pennsylvania also produced benzene (32 million gallons), toluene (8 million gallons), xylene (2.7 million gallons), and solvent naphtha (1.8 million gallons).

Peat.—Pennsylvania ranked sixth among the 19 peat-producing States; production and value of output increased 14 and 29 percent, respectively. Producers of humus and reed-sedge were active in order of decreasing importance, in Luzerne, Lawrence, Wayne, and Erie Counties. Production was not reported from Mercer County in 1959.

Petroleum and Natural Gas.—Output of crude petroleum continued to decrease, although Pennsylvania remained the 19th-ranking producer. Output decreased 5 percent in quantity and 3 percent in value. The average value of crude petroleum was $4.20 per barrel, 10 cents more than in 1958.

Pennsylvania ranked 10th in national gas production, showing an increase of 13 percent. The value of natural-gas production also increased to 28.4 cents per thousand cubic feet.

The number of wells completed in Pennsylvania again declined, dropping to 648. Of this total, 160 were oil wells, 327 gas wells, 67 dry holes, and 94 service wells. Wildcat wells completed totaled 25 less than in 1958. Of this total, 17 were dry holes, and 4 were new gas pools. Completed field wells totaled 627—1 more than in 1958. Of this number, 160 were crude-oil wells, 323 gas wells, 50 dry holes, and 94 service wells.

Total footage for completed wells was 2,078,276—an average of 3,207 feet. Footage for completed field wells was 1,967,287 and for wildcat wells, 110,989. Of the gas-well completions in 1959, 323 were field wells, and 4 were wildcat wells. This was 46 more than were placed in operation in 1958.

The proved recoverable crude-oil reserve in Pennsylvania was estimated at 113.6 million barrels as of December 31, 1959—6.3 million barrels less than was reported in 1958. The proved recoverable reserve of natural gas in Pennsylvania was 1,052,000 million cubic feet as of December 31, 1959, 182,000 million more than on December 31, 1958. Of the natural-gas reserves, 622,676 million cubic feet was nonassociated reserves, 25,040 million was dissolved, and 404,256 million was stored in underground reservoirs.

Natural-Gas Liquids.—Natural-gas liquids produced in Pennsylvania in 1959 totaled 4,368,000 gallons valued at $220,000. Output consisted of liquefied petroleum gas (manufactured at natural-gasoline plants) totaling 1,484,000 gallons and natural-gasoline and cycle products totaling 2,884,000 gallons. Average value for liquefied petroleum gases was 2.4 cents per gallon and for natural gasoline and cycle products, 6.4 cents. Reserves of natural-gas liquids as of December 31, 1959, were estimated at 3.7 million barrels—8,000 barrels less than at the end of 1958.

NONMETALS

Cement.—Activity in the Pennsylvania cement industry increased during 1959. Kilns operated at approximately 72 percent of capacity and produced 41 million barrels of portland cement. Shipments of portland and masonry cement increased 3 percent in quantity and 6 percent in value. Shipments in 1959, however, were 17 percent lower than the peak year of 1956. Portland cement was shipped to consumers in Pennsylvania, 39 other States, and the District of Columbia; 22 percent went to New York, 22 percent to New Jersey; 5 percent to Connecticut, 5 percent to Ohio, 3 percent to Maryland, and 2 percent to Massachusetts.

Masonry cement shipments, chiefly from Lehigh and Northampton Counties, increased. Masonry cement was shipped to 27 States and the District of Columbia. Thirty-nine percent was consumed in Pennsylvania, 18 percent in New Jersey, 16 percent in New York, and 11 percent in Ohio.

The principal raw materials used for manufacturing portland cement were cement rock and limestone. Totals of 8.4 million short tons of cement rock and 3.2 million tons of limestone were used. In addition, the following tonnages of raw materials were used: Gypsum, 307,304; sand, 180,729; slag, 276,902; clay, 114,155; and iron materials, 65,036. Slate, carbon black, flue dust, flint rock, and air-entraining compound also were used.

The capacity of the 24 active plants totaled 57 million barrels—73 percent by the dry process and 27 percent by the wet process. The industry consumed 974 million kilowatts of electrical energy, about 11 million kilowatts less than in 1958. Sixty-eight percent of the electrical energy was purchased from public utility companies. Stocks of portland cement decreased from 5.6 million barrels at the beginning of the year to 5.4 million barrels at yearend.

TABLE 4.—Shipments of portland cement, by counties

County	Number of plants in 1959	1958		1959	
		Barrels	Value	Barrels	Value
Lehigh	4	6,599,198	$21,769,945	6,859,370	$23,411,844
Northampton	12	19,957,871	66,432,924	20,388,750	70,617,280
Allegheny	2	7,128,370	24,317,578	7,086,699	23,991,959
Lawrence	2				
Berks	1	6,462,139	22,597,610	6,935,310	25,032,809
Butler	1				
Montgomery	1				
York	1				
Total	24	40,147,578	135,118,057	41,270,129	143,053,892

Clays.—A sharp rise in consumption of refractories overcame a drop in demand for clay by the cement and heavy-clay-products industries. Consequently, there was a 3-percent increase in the output of clay.

The production of fire clay increased 17 percent over 1958 but was 26 percent lower than the peak production of 1956. The increase was due to a 26-percent rise in the demand for refractory materials by the steel, glass, and foundry industries and a 3-percent increase in the demand for fire clay for heavy clay products. Clearfield County was the leading county for the production of fire clay in 1959, followed by Beaver and Jefferson Counties. Clearfield County also led in the number of operations—21 open pits and 8 underground mines. Altogether 85 fire-clay mines operated in the State; 53 were open pit and 32 were underground mines.

Production of miscellaneous clay continued to decline with tonnage 8 percent lower than in 1958. Lower demand for miscellaneous clay for heavy clay products, cement, and lightweight aggregate contributed to the decline. Berks County was the leading producer of miscellaneous clay, followed, in decreasing order, by Allegheny, Northumberland, and Schulykill Counties.

Output of kaolin decreased. Kaolin was used to produce firebrick and block and portland cement with all uses demanding smaller quantities than in 1958. All output was produced in Cumberland and Blair Counties.

Clay was produced in 34 counties, 1 less than in 1958 and 3 less than in 1957. Fire clay was produced in 19 counties and miscellaneous clay in 26 counties (1 less than in 1958).

TABLE 5.—Clays sold or used by producers, by kinds and uses, in short tons

Uses	Fire clay		Miscellaneous clay		Kaolin	
	1958	1959	1958	1959	1958	1959
Refractories:						
Bauxite, high-alumina brick	4,000	(1)	-----	-----	-----	-----
Firebrick and block	598,320	716,258	-----	622	(2)	4,745
Fire-clay mortar	12,516	20,575	-----	-----	-----	-----
Clay crucibles	8,669	(1)	-----	-----	-----	-----
Foundries and steelworks	65,794	101,747	(1)	(1)	-----	-----
Heavy clay products	773,295	795,058	1,414,282	1,309,546	-----	-----
Lightweight aggregate	-----	-----	103,740	(1)	-----	-----
Cement	-----	-----	232,120	202,359	(2)	24,862
Undistributed	81,681	169,531	23,183	121,058	-----	-----
Total	[3] 1,544,275	[3] 1,803,169	[4] 1,773,325	[4] 1,633,585	(2)	29,607

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Includes art pottery and stoneware (1958), floor and wall tile (1959), glass and miscellaneous refractories and items indicated by footnote 1.

[4] Includes art pottery and stoneware, floor and wall tile, foundries and steelworks, linoleum and oilcloth, miscellaneous filler (1958), other uses, and items indicated by footnote 1.

TABLE 6.—Clays sold or used by producers in 1959, by counties and uses

(X's indicate counties in which specific uses exist)

Area and county	Short tons	Value	Type of mining		Types of clay												
					Fire clay					Miscellaneous clay						Kaolin	
					Heavy clay products			Refractories	Other	Heavy clay products			Pottery	Cement	Other	Refractories	Cement
			Underground	Open pit	Building brick	Vitrified sewer pipe	Other			Building brick	Vitrified sewer pipe	Other					
Northwestern Pennsylvania:																	
Clarion	318,827	$1,902,808	4	2	X	---	X	X	---	X	---	X	---	---	---	---	---
Jefferson			3	1	X	X	X	X	---	---	X	---	---	---	---	---	---
Lawrence	272,063	685,492	---	5	X	---	X	---	---	X	---	---	---	X	X	---	---
Total northwestern Pennsylvania	590,890	2,588,300	7	8	---	---	---	---	---	---	---	---	---	---	---	---	---
Southwestern Pennsylvania:																	
Allegheny	148,240	780,169	---	7	---	---	---	---	---	X	---	X	---	---	---	---	---
Armstrong	232,045	2,519,679	6	2	X	X	X	X	---	---	---	---	---	---	---	---	---
Beaver	382,909	1,918,568	4	7	X	X	---	X	X	X	---	---	X	---	X	---	---
Butler	59,917	186,820	---	4	---	---	---	X	---	X	---	---	---	X	---	---	---
Indiana			1	---	---	---	---	X	---	---	---	---	---	---	---	---	---
Fayette	123,256	767,924	---	4	X	---	---	X	---	X	---	X	---	---	X	---	---
Somerset	81,376	627,205	3	2	X	---	---	X	---	---	---	---	---	---	---	---	---
Washington	40,790	45,257	---	3	---	---	---	---	---	X	---	---	---	---	---	---	---
Total southwestern Pennsylvania	1,068,533	6,845,622	14	29	---	---	---	---	---	---	---	---	---	---	---	---	---
North central Pennsylvania:																	
Centre	(1)	(1)	---	1	---	---	---	X	---	---	---	---	---	---	---	---	---
Clinton	(1)	(1)	---	2	---	---	---	X	---	---	---	X	---	---	---	---	---
Elk	(1)	(1)	---	1	---	X	---	---	---	---	---	---	---	---	---	---	---
Clearfield	478,476	3,179,984	8	21	X	X	---	X	---	X	X	---	---	---	---	---	---
McKean	56,718	242,287	---	3	---	X	---	X	---	X	---	---	---	---	X	---	---
South central Pennsylvania:																	
Blair	(1)	(1)	---	4	---	---	---	X	---	X	---	---	---	---	---	X	---
Cumberland	(1)	(1)	---	1	---	---	---	---	---	---	---	---	---	---	---	---	X
Dauphin	(1)	(1)	---	3	---	---	---	---	---	X	---	---	---	---	X	---	---
Huntingdon	(1)	(1)	---	2	---	---	---	X	---	---	---	---	---	---	---	---	---
Northumberland	(1)	(1)	---	3	---	---	---	---	---	X	---	---	---	---	X	---	---

Snyder	(1)	(1)	--------	2	--------	--------	--------	--------	X	--------	--------	--------	--------	--------	--------	--------	--------
York	(1)	(1)	--------	2	--------	--------	--------	--------	--------	X	--------	--------	--------	X	--------	--------	--------
Adams	71,970	36,660	--------	2	--------	--------	--------	--------	--------	X	--------	X	--------	--------	--------	--------	--------
Cambria	42,376	190,383	3	1	X	X	--------	X	--------	X	--------	--------	--------	--------	--------	--------	--------
Undistributed [2]	512,322	2,361,263	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Total north central and south central Pennsylvania	1,161,862	6,010,577	11	48	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Northeastern Pennsylvania:																	
Monroe	(1)	(1)	--------	1	--------	--------	--------	--------	--------	--------	--------	--------	--------	X	--------	--------	--------
Columbia	14,670	(1)	--------	1	--------	--------	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	--------
Luzerne	44,672	(1)	--------	1	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	--------	--------	--------
Southeastern Pennsylvania:																	
Berks	(1)	(1)	--------	2	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	--------	--------	--------
Bucks	(1)	(1)	--------	1	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	--------	--------	--------
Lancaster	(1)	(1)	--------	3	--------	--------	--------	X	--------	X	--------	--------	--------	--------	--------	--------	--------
Schuylkill	(1)	(1)	--------	2	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	X	--------	--------
Chester	80,528	(1)	--------	1	--------	--------	--------	--------	--------	X	--------	--------	--------	--------	--------	--------	--------
Montgomery	66,022	(1)	--------	4	--------	X	--------	--------	--------	X	X	X	X	--------	--------	--------	--------
Undistributed [2]	439,184	1,751,526	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Total northeastern and southeastern Pennsylvania	645,076	1,751,526	--------	16	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Grand total	3,466,361	17,196,025	32	101	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties that must be concealed as indicated by footnote 1.

Gem Stones.—The value of gem stones, including mineral specimens, was higher than in 1958. Eastern Pennsylvania, particularly Monroe, Chester, Montgomery, and Berks Counties, continued to be the most popular area for gem materials. Most of the mineral specimens were collected by members of Pennsylvania and out-of-State mineral and lapidary clubs.

Graphite, Crystalline.—Flake graphite was recovered from schist in Chester County for the first time since 1953 and marketed as crucible flake and fine flake. In addition, manufactured (artificial) graphite powder and products were produced at a plant in St. Marys. The graphite powder was sold to major steel and chemical companies.

Iron Oxide Pigments.—Output of crude iron oxide pigments decreased in tonnage and value. Production came from Cambria and Allegheny Counties. Most of the production was sulfur mud from Cambria County. Pennsylvania continued to be the leading State in the production of finished natural and manufactured iron oxide pigments. Output increased 16 percent in tonnage and 17 percent in value. The greater production was attributable primarily to the output of manufactured red iron oxide pigments, natural red iron oxide, natural brown iron oxide, and manufactured yellow iron oxide. Brown iron oxide, burnt umber, and red iron oxide were the principal finished natural iron oxide pigments; and red iron oxide, yellow iron oxide, and Venetian red were the principal manufactured iron oxide pigments. Finished natural and manufactured iron oxide pigments were produced at one plant in Carbon County and two plants at Northampton County.

Lime.—Production of lime increased 26 percent, owing largely to a greater demand for lime by chemical and refractory industries. Thirty-one percent more lime was sold for agricultural and refractory uses than in 1958 and 27 percent more for chemical and industrial uses. Of the total sold or used, 78 percent was quicklime, compared with 74 percent in 1958, and 22 percent was hydrated lime, compared with 26 percent in 1958. Most of the lime was consumed within the State (61 percent), but large quantities were shipped to Maryland (8 percent), New Jersey (7 percent), Ohio (7 percent), New York (6 percent), Delaware (3 percent) and Maine (2 percent).

Twenty companies operated 23 plants in 16 counties in 1959. Centre County continued as the leading producer with 48 percent of the State's lime production. Centre, Chester, Lebanon, Montgomery, and York Counties each had an output of over $1 million. Approximately 2.5 million short tons of limestone was used in producing lime.

TABLE 7.—Lime sold by producers, by uses

	Agricultural		Building		Chemical and industrial		Refractory		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	129,351	$1,486	123,730	$1,727	768,508	$8,682	155,894	$2,101	1,177,483	$13,996
1955	118,274	1,430	118,727	1,530	1,083,043	13,179	104,007	1,493	1,424,051	17,632
1956	360,718	5,140	110,344	1,456	972,368	11,686	(1)	(1)	1,443,430	18,282
1957	286,720	4,469	110,815	1,874	900,866	12,063	(1)	(1)	1,298,401	18,406
1958	193,433	3,077	112,437	1,839	697,188	[2] 9,245	(1)	(1)	1,003,058	[2] 14,161
1959	253,313	4,023	121,308	2,166	888,559	12,072	(1)	(1)	1,263,180	18,261

[1] Refractory lime included with "Agricultural" to avoid disclosing individual company confidential data.
[2] Revised figure.

TABLE 8.—Lime sold by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Armstrong	1,019	$11,190	816	$11,466
Centre	462,771	[1] 6,236,702	600,951	8,069,886
Dauphin	9,866	126,062	8,700	121,800
Franklin	2,046	15,549	1,887	14,241
Fulton	495	4,455	874	7,866
Juniata	----------	----------	2,200	22,000
Lebanon	151,059	1,912,460	201,000	2,810,000
Mifflin	5,656	65,589	6,670	75,278
Northumberland	420	3,682	400	4,000
Snyder	1,301	9,755	1,289	9,793
Undistributed [2]	368,425	5,775,195	438,393	7,114,506
Total	1,003,058	[1] 14,160,639	1,263,180	18,260,836

[1] Revised figure.
[2] Includes tonnage and value for the following counties: Bedford, Blair (1958), Butler, Chester, Lancaster, Montgomery, and York.

Magnesium Compounds.—Magnesium carbonate produced from dolomite at Plymouth Meeting was used to make magnesium oxide for insulation purposes. Operations were discontinued at the Keasbey & Mattison Co. Ambler Plant in 1958.

Mica.—Output of mica continued to decrease primarily because of a lower demand for ground mica for use by paint and rubber industries. The mica was mined and processed near Glenville and marketed for use in paints, mold lubricant for the rubber industry, as a filler in plastics, and for use in welding rods.

Perlite (Expanded).—Output of expanded perlite totaled 18,418 tons valued at $1,090,306, increases compared with 1958 of 27 and 37 percent, respectively. The increased output was due primarily to greater demand for expanded perlite as an aggregate in building plaster and insulation. Smaller quantities were consumed as concrete aggregate, soil conditioner, filler, and filter aid.

Pyrite.—Output of pyrite decreased 22 percent. The pyrite was obtained as a byproduct of iron-ore mining in eastern Pennsylvania. The pyrite concentrate obtained at Bethlehem was processed to recover pyrite and cobalt.

Roofing Granules.—The output of roofing granules increased in tonnage and value, owing to an increased demand for both natural granules and artificially colored granules. Slate, stone, and clay were used to produce roofing granules. Of the total production, artificially colored granules represented 74 percent, compared with 87 percent in 1958.

Sand and Gravel.—The sand and gravel industry recorded its best year since 1953 with an increase of 21 percent in tonnage and value. However, production was 9 percent below the record established in 1951. The value of sand and gravel had increased $0.40 per ton in 10 years. Pennsylvania ranked 15th in tonnage and 8th in value of sand and gravel. Commercial production was reported from 43 counties. Government-and-contractor operations were reported from Clinton, Lancaster, and Susquehanna Counties. Bucks County continued as the leading producer of sand and gravel, showing a substantial gain over the previous year. The seven southeastern counties (Berks, Bucks, Lancaster, Montgomery, Northampton, Philadelphia, and Schuylkill) contributed 38 percent of State tonnage and 32 percent of the value.

Construction of the Stillwater flood-control dam by Booth & Flinn Co., Pittsburgh, Pa., stimulated activity in northeastern Pennsylvania. The central region of the State remained the chief source of industrial sands, showing increases of 19 percent in tonnage and 28 percent in value. More than 84 percent of the sand and gravel was produced by 33 of the 98 commercial producers, each producing over 100,000 tons.

Of the total commercial sand and gravel production, 10, 26, and 64 percent was transported by rail, water, and truck, respectively.

More than 55 percent of the output was for structural uses and 30 percent for paving purposes. Industrial sands kept pace with the growth of the sand and gravel industry, recording increases of 21 percent in tonnage and 20 percent in value.

TABLE 9.—Sand and gravel sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	151,243	$457,555	173,104	$483,130
Building	3,488,941	4,931,685	3,824,920	5,476,084
Paving	1,878,762	2,809,596	2,148,497	3,218,653
Fire or furnace	(1)	(1)	105,868	380,094
Engine	53,451	110,612	77,213	192,675
Other	165,506	428,360	(1)	(1)
Undistributed [2]	840,095	3,214,234	1,355,703	4,566,873
Total	6,577,998	11,952,042	7,685,305	14,317,509
Gravel:				
Building	3,258,596	4,593,614	4,037,098	5,385,540
Paving	1,707,011	2,442,856	2,200,930	3,270,382
Undistributed [3]	119,830	112,688	301,295	247,053
Total	5,085,437	7,149,158	6,539,323	8,902,975
Total sand and gravel	11,663,435	19,101,200	14,224,628	23,220,484
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building			50	180
Paving	161,589	78,770		
Total	161,589	78,770	50	180
Gravel: Fill			32,336	12,385
Total			32,336	12,385
Total sand and gravel	161,589	78,770	32,386	12,565
Grand total	11,825,024	19,179,970	14,257,014	23,233,049

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.
[2] Includes glass, grinding and polishing, blast (1959), filter (1958), and ground sand.
[3] Includes railroad ballast and other uses.

TABLE 10.—Sand and gravel sold or used by producers in 1959, by counties and areas

(X's indicate counties in which specific uses exist)

Area and county	Short tons	Value	Sand									Gravel				Mis-cellaneous	Type of operation		Transportation		
			Construction				Industrial					Construction									
			Building	Paving	Fill	Other	Glass	Molding	Grinding and polishing	Fire and furnace	Other	Building	Paving	Fill	Other		Stationary	Portable	Rail	Water	Truck
Northwestern Pennsylvania:																					
Crawford	142,330	$179,678	X	X								X	X	X	X	X	4				X
Erie	260,322	342,261	X	X				X				X	X		X	X	4		X		X
Forest			X	X								X	X				1				X
Venango	539,980	996,091	X	X		X		X		X		X	X	X	X	X	3		X		X
Warren			X	X								X	X	X			2				X
Lawrence			X	X							X	X	X	X			2				X
Mercer	691,054	980,816	X	X	X	X						X	X			X	4				X
Total	1,633,686	2,498,846															20				
Southwestern Pennsylvania:																					
Allegheny			X	X	X			X				X	X	X			2	1	X	X	X
Armstrong	1,854,923	3,579,908	X	X		X						X	X	X	X	X	2		X		X
Beaver			X	X								X	X	X			2			X	X
Butler	133,780	193,618	X	X	X							X	X			X	2				X
Fayette	162,000	397,000	X	X								X	X					1	X	X	X
Somerset	990	2,870	X	X		X						X	X				2				X
Total	2,151,693	4,173,396															10	2			
North Central Pennsylvania:																					
Clearfield	(1)	(1)	X	X								X	X				1				X
Clinton	(1)	(1)												X				1			X
Elk	(1)	(1)	X	X								X	X					1			X
Lycoming	(1)	(1)	X	X				X			X	X	X		X		2		X		X
McKean	(1)	(1)	X	X				X				X	X				1				X
Total																	4	2			

South Central Pennsylvania:																					
Bedford	(1)	(1)	X	X								X	X				1				X
Blair	(1)	(1)	X	X								X	X				2				X
Dauphin	(1)	(1)	X	X								X	X				2				X
Fulton	(1)	(1)	X	X								X	X				1				X
Huntingdon	(1)	(1)	X	X			X	X	X		X	X	X				2		X		X
Mifflin	(1)	(1)	X	X			X	X	X	X	X	X	X				3		X		X
York	(1)	(1)	X	X						X		X	X				3		X		X
Cambria	8,000	26,000	X	X		X					X	X	X				1				X
Cumberland	171,778	313,370	X	X								X	X				3				X
Franklin	145,311	216,946	X	X		X						X	X				2	1			X
Northumberland	6,978	8,853	X	X	X			X				X	X				2		X		X
Undistributed [2]	2,846,307	6,485,252																			
Total	3,178,374	7,050,421															22	1			
Northeastern Pennsylvania:																					
Bradford	46,500	63,000	X	X								X	X					1			X
Carbon	224,523	331,898	X	X							X	X	X				3		X		X
Columbia	554,513	635,043	X	X								X	X				2				X
Wyoming			X	X		X					X	X	X	X			2	1			X
Luzerne	450,930	553,192	X	X								X	X				5	1			X
Monroe	172,294	231,003	X	X								X	X				2				X
Wayne			X	X		X						X	X				2				X
Susquehanna	478,500	287,100	X	X								X	X					1			X
Total	1,927,260	2,101,236															16	4			
Southeastern Pennsylvania:																					
Berks	5,260,362	7,089,989	X	X								X	X				2				X
Montgomery			X	X								X	X				1				X
Northampton			X	X	X							X	X				2				X
Bucks			X	X				X				X	X				8		X	X	X
Lancaster			X	X						X		X	X				3		X		X
Philadelphia			X	X								X	X					1		X	
Schuylkill	105,639	319,161	X	X						X		X	X				1		X		X
Total	5,366,001	7,409,150															17	1			
Grand total	14,257,014	23,233,049															89	10			

[1] Included with "Undistributed" to avoid disclosing individual company confidential data.

[2] Includes tonnage and value for counties that must be concealed as indicated by footnote 1.

Slag (Iron-Blast Furnace).—Output of blast-furnace slag increased, despite a slump in highway construction and a steel strike, from 7,203,000 short tons in 1958 to 7,240,000 tons in 1959. The value of output also increased from $11,334,000 to $11,847,000. Pennsylvania continued to be the leading producer of blast-furnace slag, having 26 percent of the United States tonnage.

Stone.—Output of stone (including slate and oystershell) increased in tonnage and value (9 and 11 percent, respectively). The growth was due primarily to a greater demand for dimension stone for rough construction purposes and crushed or broken stone as concrete aggregate, refractory material, and for agriculture. Stone for rubble, dressed building stone, and sundry uses for dimension and crushed stone increased. The demand for riprap, flux, railroad ballast, curbing and flagging stone, and rough architectural stone was lower in 1959. Stone (sandstone, granite, basalt, limestone, oystershell, miscellaneous stone, and slate) was produced in 46 of the 67 counties in Pennsylvania. New operations were reported in Clarion and Tioga Counties. Northampton County was the leading producing county. Counties producing over 2 million tons, in decreasing order, were: Northampton, Montgomery, York, Berks, Lawrence, Lancaster, Chester, Lehigh, and Centre. In addition, Adams, Bucks, Delaware, and Lebanon Counties each produced over 1 million tons.

Output of limestone, the leading stone produced, increased 8 percent in tonnage and 11 percent in value. This increase was due primarily to a 10-percent increase in the demand for limestone as concrete aggregate, agricultural stone, and dimension stone for building purposes. Significant decreases were reported in the use of limestone as flux and railroad ballast. Crushed limestone was produced in 35 counties—1 more than in 1958 (Clarion). Northampton County continued to be the leading county in output, with 5.8 million tons, followed in decreasing order by counties producing over 2 million tons—Montour, York, Lawrence, Lancaster, Berks, Lehigh, Centre, and Chester. Dimension limestone continued to be produced in Bucks and Lancaster Counties; most of the production came from Bucks County.

Sandstone, the third ranking stone in Pennsylvania, was marketed as both dimension and crushed stone. Output was greater than in 1958 with increases of 21 percent in tonnage and 13 percent in value. The greater output resulted primarily from an increased demand for crushed sandstone as concrete aggregate and refractory material. Refractory use increased 48 percent in tonnage, and aggregate use increased 16 percent. Crushed sandstone also was used as riprap, railroad ballast, and for miscellaneous uses, with only the use of riprap increasing. Dimension sandstone was marketed for use as rough construction stone, rubble, rough architectural stone, sawed or dressed building stone, and curbing and flagging stone. Only the use of rough and dressed construction stone and rubble showed increases over 1958. Overall, 18 percent more dimension stone was marketed in 1959 than in 1958. Crushed sandstone was marketed from 15 counties and dimension sandstone from 10 counties. Allegheny, Chester, Delaware, Potter, and York Counties produced dimension stone only.

Dimension stone also was produced in Mercer, Montgomery, Susquehanna, Wayne, and Westmoreland Counties, with Montgomery County being a leading producer of dimension stone. The leading county for the production of crushed sandstone was Wayne, and Huntingdon was the leader in value of crushed stone. Leading counties having over 100,000 short tons of crushed sandstone in decreasing order were Wayne, Luzerne, Susquehanna, Blair, and Westmoreland Counties.

Granite was prepared and marketed only as dimension stone. Production was approximately five times that reported in 1958. The increase was due primarily to greater demand for rough and dressed construction stone. In addition to rough construction stone, granite was marketed for use as rubble, rough architectural stone, and dressed building stone. Delaware County continued to be the only source of granite in Pennsylvania.

The tonnage of miscellaneous stone produced increased 75 percent. All use categories for miscellaneous stone increased. Dimension stone was marketed as rough construction stone, rubble, and curbing and flagging stone, and crushed stone was marketed for use as concrete aggregate. Crushed miscellaneous stone continued to be produced in Bucks and Montgomery Counties. Dimension miscellaneous stone was produced in Delaware, Lycoming, Potter, and Westmoreland Counties, with most of the production coming from Delaware County.

Basalt output increased primarily because of the greater demand for its use as concrete aggregate. In addition, more of the overall production of crushed basalt was used as railroad ballast and for miscellaneous uses. Riprap was the only use for crushed basalt that declined. Demand for dimension basalt, used as rough construction stone and rubble, was lower. Basalt was used as rubble for the first time. Crushed basalt was produced in eight counties, with Delaware and Berks Counties leading. Dimension basalt was produced in Bucks, Chester, and Montgomery Counties, with Montgomery County the leading source.

Oystershell was again collected in Berks County and processed for agriculture.

Pennsylvania continued to rank first in the United States in the output of slate, despite a continued drop in production. Sales of dimension slate increased slightly over 1958, with more structural and sanitary slate, billiard table slate, and flagging slate being sold. Use of slate for roofing, blackboards, and school slates declined. The lower demand for slate as granules and flour contributed greatly to the decline of the slate industry in 1959.

Dimension slate was produced in Lehigh and Northampton Counties by 12 companies. Most of the dimension stone came from 11 operations in Northampton County. Crushed slate was marketed from operations in Northampton and York Counties; a major portion of production came from one operation near Delta in York County. The three producers of crushed slate in Northampton County also produced dimension slate.

TABLE 11.—Stone sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone	160,067	$1,218,119	176,989	$1,344,896
Curbing and flagging	(1)	(1)	12,118	289,281
Other uses	49,419	3,303,682	50,134	3,320,679
Total	209,486	4,521,801	239,241	4,954,856
Crushed and broken stone:				
Riprap	27,441	23,645	10,032	11,657
Concrete and road metal	18,537,260	28,025,216	20,443,307	31,491,790
Furnace flux (limestone)	5,443,191	9,806,835	5,076,505	9,393,129
Railroad ballast	749,066	1,181,230	736,546	1,196,019
Agricultural	776,764	2,497,005	888,123	2,518,380
Other uses [2]	14,305,954	23,637,826	16,287,967	27,854,836
Total	39,839,676	65,171,757	43,442,480	72,465,811
Grand total	40,049,162	69,693,558	43,681,721	77,420,667

[1] Included with "building stone."
[2] Includes "refractory."

TABLE 12.—Stone sold or used, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Adams, Cumberland, Franklin	(1)	(1)	2,906,992	$6,260,476
Berks	2,421,954	$2,871,294	2,911,256	3,922,354
Blair, Huntingdon	1,292,864	3,544,709	1,153,003	3,110,245
Bucks	723,545	1,378,818	1,714,805	2,962,656
Butler	911,054	1,721,255	877,883	1,757,108
Carbon, Monroe, Schuylkill	397,445	1,854,012	431,930	1,814,413
Centre	1,786,483	3,328,604	2,120,484	4,275,778
Chester	(1)	(1)	2,506,541	5,347,571
Dauphin, Lebanon, Perry	3,097,531	5,219,468	(1)	(1)
Delaware, Chester	3,486,163	6,634,978	(1)	(1)
Fayette, Somerset	574,051	1,094,813	633,560	1,336,633
Franklin	595,540	971,805	(1)	(1)
Juniata, Mifflin, Snyder	805,623	1,292,431	(1)	(1)
Lancaster	1,872,585	3,047,407	2,508,298	3,763,864
Lawrence	3,102,531	5,361,898	2,884,686	5,155,072
Lebanon	(1)	(1)	1,853,672	3,126,445
Lehigh, Northampton	7,538,588	10,368,901	8,047,822	11,152,655
Luzerne	(1)	(1)	211,109	345,458
Mercer	11,808	39,944	13,235	49,690
Montgomery	3,644,264	6,151,576	3,661,015	6,326,769
Northumberland	58,700	100,950	53,400	94,280
Snyder	(1)	(1)	77,999	135,935
Susquehanna, Luzerne, Wyoming	354,671	717,095	(1)	(1)
Tioga	------	------	115	2,800
Union	212,950	356,300	282,028	464,487
Wayne	115,343	246,471	(1)	(1)
Westmoreland	520,904	961,715	567,190	1,068,130
Undistributed [2]	6,524,565	12,429,114	8,264,698	14,947,848
Total	40,049,162	69,693,558	43,681,721	77,420,667

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes tonnage and value for counties as indicated by footnote 1 and the following counties: Allegheny, Armstrong, Bedford, Clarion (1959), Clinton, Fulton, Lycoming, Montour, Potter, and York.

Sulfur.—Byproduct sulfur continued to be recovered in the liquid purification of natural gas obtained from domestic and foreign deposits. The Sinclair Refining Co. Marcus Hook refinery used the

Claus process to produce liquid sulfur and hydrogen sulfide. Gulf Oil Corp. also used the Claus process to recover byproduct sulfur at its Philadelphia refinery. The Atlantic Refining Co. (Philadelphia) recovered hydrogen sulfide by the Girdler process for the production of sulfuric acid for use at the local plant. Sulfur also was recovered at the Sun Oil Co. Marcus Hook refinery, using a two-stage catalytic oxidation of hydrogen sulfide.

Talc.—Output of pyrophyllite (serecite schist) and soapstone increased, due mainly to a growth in demand for these materials as a filler in asphaltic compounds, insecticides, and roofing materials. The serecite schist was processed at Aspers, and the soapstone was transported to Marriottsville (Carroll County, Md.) for processing.

Tripoli.—Greater demand for filler material contributed to increased production of tripoli. In addition to filler, tripoli was used as a buffing compound.

Vermiculite (Exfoliated).—Crude vermiculite from Western States and foreign countries continued to be exfoliated at plants in Bucks and Lawrence Counties. Operations in Clearfield County were discontinued in the latter part of 1958. The exfoliated vermiculite was used for sundry uses, including insulating refractories and construction insulation.

METALS

Cadmium.—Cadmium continued to be recovered from zinc dust at the St. Joseph Lead Co. Josephtown plant and the New Jersey Zinc Co. Palmerton smelter.

Ferroalloys.—Production of ferroalloys decreased to 376,905 short tons from 412,300 tons in 1958. Shipments consisted of ferromanganese, spiegeleisen, ferromolybdenum, ferrotungsten, ferrocolumbium, ferroboron, aluminum-vanadium, molybdenum-aluminum, nickel-tungsten, and nickel-columbium.

Iron Ore.—Shipments of usable iron ore from mines in Pennsylvania increased despite a 116-day steel strike. All ore (magnetite) produced at the Cornwall and Grace underground mines was shipped to the Lebanon and Morgantown concentrators for processing, respectively. Concentrate from the Lebanon concentrator and a small quantity of concentrate from the Morgantown concentrator were processed at a local agglomerating plant. Shipments from the Lebanon plant consisted of concentrate and agglomerates (sinter and pellets) for use in producing pig iron and steel. Shipments from the Morgantown concentrator consisted primarily of concentrate for direct use in producing pig iron and steel. Copper, cobalt, and pyrites also were recovered from the ores.

Iron and Steel Scrap.—Ferrous scrap was collected and prepared primarily in Pittsburgh, Glassport, Harrisburg, Dunmore, Kittanning, Greensburg, Sharpsburg, and Conshohocken. Active plants varied monthly from 75 to 86. The leading varieties of scrap processed and shipped were Nos. 1 and 2 heavy-melting steel and No. 2 and all other bundles.

TABLE 13.—Shipments of ferrous scrap by dealers, brokers, and automobile wreckers in 1959, by grades in short tons

Grades of scrap	Shipments from yard		Direct shipments, other than from yard operations	
	To domestic consumers	For export	To domestic consumers	For export
No. 1 Heavy Melting steel	186,918	19,140	10,021	3,630
No. 2 Heavy Melting steel	65,113	12,588	1,697	4,216
No. 1 and electric furnace bundles	(1)	(1)	22,530	----------
No. 2 and all other bundles	91,628	8,773	29,627	2,019
Low-phosphorus scrap	32,033	643	11,549	----------
Cast-iron scrap other than borings	58,686	236	3,273	----------
Turnings and/or borings, alloy free	(1)	(1)	4,582	----------
Rerolling rails	326	----------	644	----------
Scrap rails	4,169	20	852	----------
Stainless steel	5,890	----------	1,169	----------
All other alloy iron and steel	1,199	----------	1,176	----------
Undistributed [2]	163,596	1,328	34,739	----------
Total	609,558	42,728	121,859	9,865

[1] Figure withheld to avoid disclosing individual company confidential data.

[2] Includes tons of high-speed steel scrap, all other prepared scrap, unprepared scrap, and items indicated by footnote 1.

Molybdenum.—Climax Molybdenum Co. operated its plant at Langeloth, Washington County to produce ferromolybdenum and molybdic oxide from molybdenum concentrate originating at the company mine and mill in Climax, Colo.

Pig Iron.—Despite the 116-day steel strike pig iron production totaled 15.1 million net tons, a 4-percent increase over 1958. The pig iron was produced by 14 companies operating 23 plants having 78 stacks. The classes of pig iron produced in 1959 were basic, Bessemer, foundry, low-phosphorus, malleable, and direct casting. More basic and Bessemer pig iron were produced than other classes, totaling 13.2 million short tons of basic (8-percent increase) and 972,000 tons of Bessemer, (40-percent decrease). In blast furnaces, raw-material consumption totaled 9.7 million tons of domestic iron ore, 4.1 million tons of foreign iron ore, 740,800 tons of mill cinder and roll scale, 21,700 tons of flue dust, 1.3 million tons of open-hearth and Bessemer slag, 11.9 million tons of coke, 4.2 million tons of limestone and dolomite, 71,000 tons of pig iron and hot metal, 807,900 tons of home and purchased scrap, 187,600 tons of slag scrap, 7.8 million tons of sinter, and 670,000 tons of pellets. In addition, manganiferous ore, coke breeze, anthracite, self-fluxing agglomerates, nodules, briquettes, and foreign agglomerates were consumed in making pig iron. A total of 3.6 million short tons of domestic iron ore, 233,900 tons of mill cinder and roll scale, 1.3 million tons of flue dust, 234,800 tons of anthracite, and some foreign iron ore, manganiferous ore, and limestone and dolomite and coke breeze were consumed in agglomerating plants in Pennsylvania to produce sinter and self-fluxing agglomerates.

TABLE 14.—Consumption of pig iron and ferrous scrap by type of furnace, in short tons

Type of furnace and raw material	1958	1959	Type of furnace and raw material	1958	1959
Open-hearth furnaces:			Air furnaces:		
Pig iron	12,352,563	13,301,590	Pig iron	35,195	47,064
Scrap	8,142,654	9,960,128	Scrap	109,366	148,385
Total	20,495,217	23,261,718	Total	144,561	195,449
			Blast furnaces: Scrap	1,020,784	1,027,609
Bessemer converters:[1]					
Pig iron	792,223	752,653	Miscellaneous uses:		
Scrap	248,801	275,731	Pig iron (Direct casting)	944,801	1,116,514
Total	1,041,024	1,028,384	Scrap[3]	87,196	86,648
Electric steel furnaces:[2]			Total	1,031,997	1,203,162
Pig iron	22,311	27,047			
Scrap	1,388,008	1,774,097	Total Pennsylvania:		
			Pig iron	14,355,285	15,489,188
Total	1,410,319	1,801,144	Scrap	11,489,204	13,866,340
Cupola furnaces:			Total	25,844,489	29,355,528
Pig iron	208,192	244,320			
Scrap	492,395	593,742			
Total	700,587	838,062			

[1] Includes scrap and pig iron consumed in basic oxygen steel process.
[2] Includes small quantity of scrap and pig iron used in crucible furnaces.
[3] Miscellaneous includes rerolling, reforging, and ferroalloy.

Zinc.—Production of zinc concentrate increased over 50 percent in 1959. The ore produced at the Friedensville mine was concentrated at a nearby plant, and the concentrate was shipped to the Palmerton smelter for processing.

Smelters.—The Palmerton and Josephtown smelters were active in 1959. The Palmerton plant of New Jersey Zinc Co. processed crude ore or concentrate from company operations at Friedensville, Pa.; Austinville, Va.; Jefferson City and Treadway, Tenn.; Canyon City, Colo.; and other domestic and foreign sources. Both zinc and lead were produced. The Josephtown smelter of the St. Joseph Lead Co. processed zinc concentrate received from the company's Edwards and Balmat, N.Y., and Indian Creek, Mo. operations, as well as materials from other States and foreign countries. Plant improvements at the St. Joseph Lead plant centered on the construction of a special high-grade zinc column and development of a continuous-flow technique of casting high-purity zinc into 2,500 pound ingots. Construction of a new roasting and acid plant was completed at Palmerton. In addition, a more efficient, electrically operated system of removing residue from slab zinc furnaces was installed.

REVIEW BY COUNTIES

Adams.—Two companies operated limestone quarries near Gettysburg and Fairfield, producing crushed stone for use as concrete aggregate and roadstone. Bethlehem Limestone Co. quarried and crushed limestone at the quarry and plant west of Hanover, chiefly for blast-furnace flux, concrete aggregate, and stone sand. Quantities of roadstone were sold under contract to nearby Government agencies. The Funkhouser Mills, Division of The Ruberoid Co., continued to operate the Carmian quarry, east of Charmian in Adams County, to produce crushed and ground stone for use as roofing granules and stone flour.

Liberty Stone Co. produced soapstone at a pit near Fairfield and transferred the crude material to its Marriottsville, Md., plant for processing. Summit Mining Corp. recovered sericite schist at the Heller No. 3 mine, 3 miles west of Bendersville. The crude material was trucked to the company plant at Aspers to be crushed, screened, and ground primarily for use as a filler in asphaltic compounds and joint cements and for use in insecticides.

TABLE 15.—Value of mineral production in Pennsylvania [1][2][3]

County	1958	1959	Minerals produced in 1959 in order of value
Adams	(4)	(4)	Stone, sericite schist, clays.
Allegheny	$45,620,873	$43,462,995	Cement, coal, clays, sand and gravel, iron ore (pigment material), stone.
Armstrong	(4)	(4)	Coal, sand and gravel, clays, lime, stone.
Beaver	(4)	(4)	Clays, coal, sand and gravel.
Bedford	1,620,266	(4)	Coal, stone, lime, sand and gravel.
Berks	9,411,867	13,690,800	Cement, iron ore, stone, clays, sand and gravel, gem stone.
Blair	1,982,391	2,218,760	Stone, coal, clays, sand and gravel.
Bradford	(4)	87,881	Sand and gravel, coal.
Bucks	(4)	(4)	Sand and gravel, stone, clays, gem stone.
Butler	13,648,257	14,803,739	Coal, cement, lime, stone, sand and gravel, clays.
Cambria	53,453,928	42,242,812	Coal, clays, sand and gravel, iron ore (pigment material).
Cameron	(4)	171,706	Coal.
Carbon	(4)	(4)	Coal, stone, sand and gravel.
Centre	(4)	(4)	Lime, coal, stone, clays.
Chester	5,664,017	(4)	Stone, lime, clays, graphite, gem stone.
Clarion	10,658,426	(4)	Coal, stone, clays.
Clearfield	(4)	26,836,053	Coal, clays, sand and gravel.
Clinton	2,530,185	2,708,633	Coal, stone, clays, sand and gravel.
Columbia	(4)	(4)	Coal, sand and gravel, clays.
Crawford	154,417	179,678	Sand and gravel.
Cumberland	(4)	(4)	Stone, sand and gravel, clays.
Dauphin	3,645,000	3,317,375	Stone, coal, clays, sand and gravel, lime.
Delaware	(4)	2,608,524	Stone.
Elk	1,654,417	1,370,674	Coal, clays, sand and gravel.
Erie	(4)	(4)	Sand and gravel, peat.
Fayette	19,646,651	(4)	Coal, stone, clays, sand and gravel.
Forest	(4)	(4)	Sand and gravel.
Franklin	1,183,313	(4)	Stone, sand and gravel, lime.
Fulton	(4)	(4)	Do.
Greene	62,201,305	61,165,085	Coal.
Huntingdon	5,065,357	4,931,074	Sand and gravel, stone, coal, clays.
Indiana	(4)	(4)	Coal, clays.
Jefferson	(4)	(4)	Do.
Juniata	(4)	(4)	Stone, lime.
Lackawanna	19,938,059	19,614,830	Coal.
Lancaster	(4)	(4)	Stone, coal, sand and gravel, lime, clays, gem stones.
Lawrence	(4)	(4)	Cement, stone, coal, clays, sand and gravel, peat.
Lebanon	18,967,978	16,449,766	Iron ore, lime, stone, copper, cobalt, gold, pyrite, silver, coal.
Lehigh	(4)	(4)	Cement, zinc, stone, gem stone.
Luzerne	68,949,149	(4)	Coal, sand and gravel, stone, peat, clays.
Lycoming	1,555,434	1,806,045	Stone, sand and gravel, coal, tripoli.
McKean	455,381	436,981	Clays, coal, sand and gravel.
Mercer	3,101,323	2,585,092	Coal, sand and gravel, stone.
Mifflin	(4)	(4)	Sand and gravel, stone, lime.
Monroe	(4)	(4)	Stone, sand and gravel, gem stone.
Montgomery	12,620,278	13,964,287	Cement, stone, lime, clays, sand and gravel, gem stone.
Montour	(4)	(4)	Stone.
Northampton	(4)	(4)	Cement, stone, sand and gravel, coal, gem stone.
Northumberland	(4)	(4)	Coal, clays, stone, sand and gravel, lime.
Perry	(4)	(4)	Stone.
Philadelphia	399,767	485,638	Sand and gravel, gem stone.
Potter	(4)	(4)	Stone.
Schuylkill	(4)	65,530,404	Coal, stone, sand and gravel, clays.
Snyder	477,614	548,014	Coal, clays, stone, lime.
Somerset	(4)	(4)	Coal, clays, stone, sand and gravel.

See footnotes at end of table.

TABLE 15.—Value of mineral production in Pennsylvania[1][2][3]—Continued

County	1958	1959	Minerals produced in 1959 in order of value
Sullivan	$88,755	$81,311	Coal.
Susquehanna	(4)	(4)	Stone, sand and gravel.
Tioga	1,465,869	1,217,688	Coal, stone.
Union	356,300	464,487	Stone.
Venango	(4)	2,616,378	Coal, sand and gravel.
Warren	(4)	(4)	Sand and gravel.
Washington	69,836,603	64,510,269	Coal, clays.
Wayne	(4)	(4)	Stone, sand and gravel, peat, coal.
Westmoreland	21,052,979	19,643,023	Coal, stone.
Wyoming	(4)	(4)	Sand and gravel, stone.
York	14,902,598	15,875,371	Cement, stone, lime, sand and gravel, clays, mica.
Undistributed	[5] 409,731,227	418,192,816	
Total	[5] 882,040,000	863,818,000	

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[1] Pike County is not listed because no production was reported.

[2] Excludes value of production for LP-gases, natural gasoline, petroleum, and some gem stone unspecified by counties, but value is included with "Undistributed."

[3] Excludes values of clays and stone used in manufacturing lime and cement.

[4] Figure withheld to avoid disclosing individual company confidential data.

[5] Revised figure.

Gettysburg Drain Tile Works (Gettysburg) and Alwine Brick Co. (New Oxford) mined miscellaneous clay from open pits and used the clay for making draintile and building brick, respectively.

Allegheny.—Shipments of cement from Allegheny County declined. Universal Atlas Cement, Division of U.S. Steel Corp., manufactured portland and masonry cements using the dry process. Two 360- x 10-foot rotary kilns were operated at the company plant at Universal. Pittsburgh Coke & Chemical Co., Green Bag Cement Division, at its Neville Island plant, produced chiefly by the wet process portland-pozzolan cement and some waterproof-portland and masonry cements. Major shipments were by truck to points in Pennsylvania, Ohio, and West Virginia.

Bituminous coal was produced from underground and strip mines, with underground tonnage comprising 88 percent of the production. Twenty-nine underground mines were active—3 less than in 1958. A total of 92 cutting machines cut 4.2 million tons of coal; 4.1 million tons of coal was mechanically loaded, and 3.2 million tons was mechanically cleaned. Of the mechanically cleaned coal, 90 percent was wetwashed, with jigs accounting for 33 percent. Twenty-seven strip mines, 2 more than in 1958, produced coal, using 38 power shovels and 8 draglines. Most of the draglines and shovels had less than 3-cubic-yards capacity.

Allegheny County ranked second in the State as a miscellaneous-clay-producing area. Seven clay producers operated open pits near Creighton (2), McKeesport, Bridgeville, Pitcairn, Wilkinsburg, and Pittsburgh. The miscellaneous clay was used principally for making building brick. Milliken Brick Co., Inc., (Wilkinsburg) was the leading clay producer in the county.

The combined output of McCrady, Inc., and Sidwell Loam Sand Co. halted the steady decline of the sand and gravel industry in the area for the first time since 1954. Sand and gravel was processed for foundry and building uses and fill.

Pennsalt Chemicals Corps, produced and marketed crude red iron oxide pigments from dump piles near Natrona.

Nick Gioia, Elizabeth Township, produced dimension sandstone as rubble. Malli Mines produced dimension sandstone as irregular-shaped building stone from a quarry in Jefferson Borough.

Panacalite Perlite Co. (Pittsburgh) and Perlite Manufacturing Co. (Carnegie) expanded perlite from crude material obtained from Nevada and New Mexico. The material was sold or used mainly for use in building plaster.

Armstrong.—Fifty-eight bituminous coal underground mines, 36 strip mines, and 9 auger mines were active in 1959. This represented an increase of two underground and three auger mines and a decrease of one strip mine. Slightly more coal was produced from strip mines than from underground mines. Forty-seven power shovels and 19 draglines were operated; 45 of the power shovels had less than 3-yards capacity; 4 draglines had 3-yards capacity; and 11 had between 3- and 5-yards capacity. Eighty-nine cutting machines mechanically cut 1.2 million tons of coal. Eighty-five percent of the underground production was mechanically loaded, and 39 percent was mechanically cleaned. Pneumatic and other wetwashing methods were used for cleaning the coal.

J. K. Davison & Bros., Glacial Sand & Gravel Co., and Manorville Sand Co. processed sand and gravel for commercial and local and State government consumption. Armstrong County continued as the second-ranking sand and gravel producing area and the center of the industry in southwestern Pennsylvania.

Production and value of clay increased 7 percent compared with 1958, and the county ranked fourth in tonnage and second in total value. Fire clay was sold or used mainly for making firebrick and block and building brick. Six underground mines were operated in the county near Kittanning (2), Freeport, Templeton, Adrian, and New Bethlehem, and two open-pits were operated near Craigsville and Worthington. The Bridgeport underground operation of Haws Refractories Co., near Kittanning, was idle.

Hydrated lime sold for agricultural purposes was burned by three producers (all near Kittanning).

Two producers, both near Kittanning, quarried and crushed limestone solely for use in making lime.

Beaver.—Beaver County ranked second in tonnage of clay produced and third in value, with both showing a slight increase. Chief uses for fire clay sold or used were for making heavy clay products (building brick), floor and wall tile, and firebrick and block, and in foundries and steelworks. Some miscellaneous clay was used in manufacturing building bricks, art pottery, and flowerpots. Four underground and seven open-pit mines were operated; three near Darlington, two each near New Brighton and Fallston, and one each near Beaver Falls, Vanport, New Galilee, and Negley.

Ninety-three percent of the bituminous coal production came from 24 strip mines. The remainder was obtained from four underground mines. Twenty-six power shovels, 8 draglines, 16 bulldozers, 3 horizontal power drills, and 2 vertical power drills were used at the stripping operations. At the underground mines, four cutting machines and two loading machines were used, with 40 percent of the county production being mechanically loaded. None of the underground production was mechanically cleaned.

Shippingport Sand & Gravel Co. (Shippingport) and Lee Block Co. (Industry) prepared sand and gravel for building and paving use.

Bedford.—Sixty-two percent of the bituminous coal production came from 24 underground mines. Of the underground production, 39 percent was mechanically loaded, and none was mechanically cleaned. At the four strip mines, six power shovels, three draglines, six bulldozers, and two horizontal power drills were used.

J. Mason Kerr (Hyndman) produced crushed limestone for use in making lime. New Enterprise Stone & Lime Co. (Everett) crushed limestone at its Ashcom plant, principally for concrete aggregate, asphalt fill, dust for coal mines, and agricultural uses. Leap Ganister Rock Co. produced ganister rock at its No. 1 quarry near Madley. The stone was crushed and sized at a local plant for use as furnace or converted linings and in making ferrosilicon.

J. Mason Kerr produced and sold quicklime for agricultural purposes, using one pot kiln at its plant near Hyndman. New Enterprise Stone & Lime Co. produced and sold hydrated lime for agricultural purposes at its Ashcom plant near Everett.

Feight Bros. (Everett) produced sand and washed it at a local preparation plant for use as building material.

Berks.—Shipments and value of portland cement increased 4 and 9 percent, respectively. Allentown Portland Cement Co. produced portland and masonry cements at its No. 1 five-kiln plant (Evansville). Major shipments to ready-mixed concrete companies were mostly in bulk by railroad to locations in Pennsylvania, New York, New Jersey, and Connecticut. Smaller quantities were shipped to other eastern States.

Bethlehem Cornwall Corp., a subsidiary of Bethlehem Steel Co., continued operating its Grace underground mine, producing crude iron ore, 90 percent by block caving, 5 percent by open stope, and 5 percent by shrinkage stoping. The crude ore was processed at the local company concentrator by flotation and magnetic concentration.

Production and value of stone increased 20 and 39 percent, respectively. Four companies quarried and crushed limestone at six operations in the county—two near Evansville and one each near Temple, Sinking Spring, Kutztown, and Oley. The stone was used chiefly for concrete aggregate, cement, and asphalt filler. Eighty-four percent of the stone produced was shipped by truck. Oystershell was crushed for use as poultry grit and mineral food. Basalt, produced by the John T. Dyer Quarry Co. at the Clingan quarry (Birdsboro), was crushed and sized at a local plant for railroad ballast and roadstone.

Glen-Gery Shale Brick Corp. (Wyomissing and Shoemakersville) produced miscellaneous clay for use in manufacturing building brick from open-pit operations.

John H. Gring (Sinking Spring) produced building sand and gravel and paving gravel for use by local builders. Building sand and gravel was produced by Schildt Bros. (Temple).

Gem-quality travertine, heulandite, and diopside were collected near Temple, Gibralter, and Quakertown. Some of the stones were for collectors items and for making novelty jewelry.

Blair.—Crushed limestone was produced by six companies operating seven quarries near Hollidaysburg, Altoona, Claysburg, Canoe Creek, and Roaring Spring. Output was used chiefly for concrete aggregate, roadstone, and agricultural purposes. The leading producer was New Enterprise Stone & Lime Co. General Refractories Co., Claysburg quarry (Claysburg) and J. L. Hartman, Sara Furnace quarry (Sproul), mined and crushed quartzite for use in making silica brick. Basalt Trap Rock Co., Williamsburg, quarried and crushed quartzite for use as railroad ballast, road material, and riprap.

Bituminous coal was produced from two underground mines and two strip mines, compared with three underground mines, three strip mines in 1958. No production came from auger mines as did in 1958.

The output of clay (kaolin, fire clay, and miscellaneous clay) continued to decline. Kaolin was recovered from the No. 1 open pit near Williamsburg and sold for use in making firebrick and block. Woodbury Clay Co., Williamsburg, produced and sold plastic fire clay for use in manufacturing foundry refractories. Blair Clay Products, Inc., east of Ashville, produced miscellaneous clay for manufacturing building brick.

General Refractories Co. (Frankstown) produced gravel for building use. Frankstown Sand Co. (near Hollidaysburg) produced building sand.

The Chimney Rocks Lime & Stone Co. (Hollidaysburg) did not operate its lime plant.

Bradford.—All sand and gravel produced for paving use by Towanda Sand & Gravel Co., Inc., was purchased by the Pennsylvania Department of Highways.

Bituminous coal was produced solely from one strip mine. The mine used one power shovel and one bulldozer.

Bucks.—The first increase in sand and gravel output since 1956 was reported; this strengthened the position of Bucks County as the leading county in sand and gravel production. Four of the eight companies producing sand and gravel met the increased demand. Shipments of sand and gravel by waterway again exceeded the combined tonnage transported by rail and truck. Material processed was used primarily for building and paving uses.

Four limestone quarries were operated near Rushland, Buckingham, New Hope, Eureka, and Langhorne and yielded limestone crushed chiefly for use as concrete aggregate. Edward Karpinski (Langhorne) produced dimension limestone for use as rough construction. Coopersburg Granite Co. produced dimension basalt at its quarry east of Coopersburg in Bucks County for dressed architectural and monumental stones and rubble. Edison Quarry, Edison, quarried dimension basalt as rough and dressed construction stone. Four operators near Edison, Ottsville, Telford, and Quakertown quarried and crushed basalt chiefly for concrete and roadstone and also for use as railroad ballast and for filter beds in sewage plants. Samuel M. Yoder Estate operated the Blooming Glen Crushing Works and quarry at Blooming Glen (redstone and bluestone), and George Wiley operated Wiley's quarry (bluestone) near Point Pleasant. Both companies quarried and crushed sandstone for road material. Better Materials Corp., Rushland, quarried miscellaneous stone (argillite), crushed it at its local plant, and marketed it for use as concrete aggregate and roadstone.

Miscellaneous clay used for the manufacture of building brick was recovered by Quakertown Brick & Tile Co. (Quakertown).

Greenockite, a semiprecious stone, was collected by a hobbyist.

Vermiculite, imported from the Union of South Africa by Hyzer & Lewellen, was processed at the company's Southampton plant. The material was sold or used primarily for residential and refractory insulation products.

Butler.—Bituminous coal was produced from 28 underground mines, 38 strip mines, and 3 auger mines, 3 additional underground mines and 1 more auger mine than in 1958. Forty-two cutting machines and 14 loading machines were used in the underground mines, 42 percent of the production was mechanically loaded. Fifty-five power shovels, 37 draglines, 1 carryall, and 47 bulldozers were used at the strip mines. Only 26 percent of the coal was mechanically cleaned, all by jigs.

Penn-Dixie Cement Corp. used captive crushed limestone for manufacturing Types I–II–III portland and mortar cements by the wet process at its No. 9 West Winfield plant. Two 250- x 10.6-foot rotary kilns were operated. The major output of cement was shipped by truck, in bulk, mostly to ready-mixed concrete companies. The material was sent mainly to points in Pennsylvania, West Virginia, and Ohio.

Mercer Lime & Stone Co. produced quicklime and hydrated lime at its plant one-half mile west of Branchton. Quicklime and hydrated lime was marketed for chemical and industrial uses, and some hydrated lime was sold for agricultural purposes.

Output of limestone was from four quarries, two near West Winfield and one each near Harrisville and Branchton. The crushed limestone was chiefly for concrete aggregate, roadstone, cement manufacture, and agricultural purposes. Forty-eight percent of the stone was transported by truck. The remainder was shipped by unspecified conveyances or consumed at the local plants.

Sand and gravel for building needs was supplied by H. W. Cooper and Highway Sand & Gravel Co., Inc., both operating stationary plants near Slippery Rock.

Glenn R. Boosel (West Sunbury) produced flint fire clay for making refractory mortar. Scott Borland Brick Yard (Mars) recovered shale to make building brick at the company plant. McCrady Refractories, Inc. (Slippery Rock) recovered and sold plastic fire clay for the manufacture of refractories for foundries and steelworks.

Cambria.—Ninety-two underground mines, 27 strip mines, and 1 auger mine were worked in 1959 for bituminous coal. Ninety-three percent of the production came from the underground mines, 6 percent from strip mines, and the remainder from the auger mine. Two hundred and five cutting machines and 243 loading machines were used in the underground operations; 96 percent of the underground production was mechanically loaded. Fifty power shovels, 16 draglines, 36 bulldozers, 10 horizontal power drills, and 4 vertical power drills were used at the strip mines. Approximately 69 percent of the coal production was mechanically cleaned. A little over half of the coal was mechanically cleaned using pneumatic methods.

Fire clay used for making heavy clay products was mined from pits near Patton and South Fork, and miscellaneous clay for use in making building brick was mined near Johnstown.

Nicosia Stone Quarry produced sand for building brick and other building uses.

Lanzendorfer Minerals Co. produced and sold iron oxide pigments of the sulfur mud variety from its No. 31 mine near Nanty Glo for use in making paint pigments.

Cameron.—The entire production of bituminous coal came from one strip mine. Three power shovels, one dragline, and three bulldozers were used at this mine.

Carbon.—Production and value of anthracite increased considerably (40 and 49 percent, respectively). Leading producers were: Coaldale Mining Co., Inc.; Valley Stripping Corp.; and Pollock Trucking Co. Anthracite was mined from underground mines, strip pits, and culm banks.

North American Refractories produced quartzite at the Little Gap mine and crushed the stone at its Palmerton plant for use in making silica brick.

Alliance Sand Co., Inc., operated its pit and fixed plant near Palmerton, producing prepared sand for paving, cement manufacture, and other building uses. Other operating sand and gravel plants were Wagner Sand Co. (near Hazleton), producing both sand and gravel for building use, and Butz Lumber Co. (Palmerton), preparing only building sand.

Centre.—Output and value of hydrated lime and quicklime increased 30 and 29 percent, respectively, and Centre County again ranked as the leading lime-producing area. Three producers each operated three rotary limekilns near Bellefonte. Quicklime and hydrated lime were sold chiefly for industrial and chemical uses, with smaller quantities for building and agricultural uses.

One auger mine, 17 bituminous coal underground mines, and 18 strip mines were active. Ninety-two percent of the county's production came from the strip mines where 35 power shovels, 11 draglines, and 31 bulldozers were used. At underground operations, seven cutting machines and one loading machine were used, with 25 percent of the underground production loaded mechanically. Pneumatic methods were used to clean a small quantity of the bituminous coal produced.

Limestone, the only stone produced in the county, increased 19 and 28 percent in tonnage and value, respectively. The principal uses of the limestone were for concrete aggregate, lime manufacture, open-hearth flux, glass making, and stone sand. Six companies reported output of crushed and broken limestone, principally from quarries near Bellefonte, State College, and Pleasant Gap.

Harbison-Walker Refractories Co. mined fire clay at the Blair clay pit.

Chester.—The leading limestone producer in the county, Bradford Hills Quarry, Inc., operated a quarry and crushing plant near Downingtown, producing crushed and broken limestone as road material. The company also sold stone for road construction to local government agencies. The Cedar Hollow quarry and plant at Devault, operated by Warner Co., Bellefonte Division, yielded limestone crushed for use as road material and blast-furnace flux at chemical plants, in the manufacture of refractories and lime, and for agricultural purposes. Quicklime and hydrated lime were produced chiefly for sewage and trade-waste treatment and agricultural use. Hydrated lime was sold for building lime. The company's Johnson quarry and plant near Paoli yielded limestone solely for use as concrete aggregate and roadstone. Valley Forge Stone Co. produced crushed limestone at its quarry and plant near Malvern, chiefly for use as road material. Some crushed limestone was used for blast-furnace flux.

French Creek Granite Co.'s basalt quarry near Saint Peters yielded dimension stone (black diabase) for use as rough and dressed architectural stone and ornamental stone for monuments and mausoleums. Three producers quarried and crushed basalt near Devault, Glenmoore, and Saint Peters chiefly for concrete aggregate, roadstone, railroad ballast, and riprap. Most of the stone was sold to local and nearby government agencies for road construction. Abram T. Minor, Avon-Grove quarry (Avondale); and Albert Rotunno, Rotunno quarry (West Grove) produced dimension sandstone (bluestone). The stone was sold or used as irregular-shaped building stone, rubble, and flagging stone. Bacton Hill Quarry (Malvern) and John Fecondo & Sons (Avondale) quarried dimension sandstone as irregular-shaped construction stone and rubble. The stone from the Bacton Hill Quarry was used on the exterior of the George Washington Motor Lodge (King of Prussia) and the Lower Merion Township School (Gladwyne), both in Montgomery County.

Clay tonnage and value each increased 11 percent. Miscellaneous clay was mined near Phoenixville by McAvoy Vitrified Brick Co. and used at the company plant for making building brick.

Graphite Corp. of America began producing crucible flake and fine flake at Chester Springs.

Semiprecious gem specimens (mostly kyanite, quartz, pyromorphite, and iron and lead minerals) were collected near Cornog, Chester Springs, French Creek, Saint Peters, and Phoenixville.

Clarion.—Clarion County again ranked second in the State in strip mining of bituminous coal, with 14 percent of the State's strip-mine tonnage. Seventy-eight power shovels, 35 draglines, and 60 bulldozers were used at the 31 (2 more than in 1958) active strip mines. Smaller quantities were produced by 12 underground mines and 1 auger mine. Sixty-six percent of the coal produced was mechanically loaded. Forty percent was mechanically cleaned, 38 percent by jigs and 62 percent by other wet methods.

Limestone for use as concrete aggregate, roadstone, for agricultural purposes, and stone sand was produced by Allegheny Mineral Corp. at a quarry and plant east of Parker.

Clay production increased 25 percent in tonnage but dropped 10 percent in value. Six companies operated four underground mines and two open pits. Fire clay was sold or used for manufacturing heavy clay products and firebrick and block. Miscellaneous clay was used for making building brick and structural tile. Clay producing areas were: New Bethlehem, Lucinda, Clarion, and West of Corsica in Clarion County.

Clearfield.—Clearfield County dropped from the leading producer of bituminous coal to the second-ranking county. However, the county led in production of bituminous coal from strip mines. One hundred and six strip mines were active, three less than in 1958. Production from strip mines totaled 4.8 million tons. Two hundred and twenty-three power shovels, 97 draglines, 5 carryalls, 201 bulldozers, 32 horizontal power drills, and 39 vertical power drills were used for strip operations. One less underground mine was operated in 1959, with production of underground mines totaling 1.1 million tons. Of the coal mined underground, 1 million tons was by 126 cutting machines and 687,000 tons was mechanically loaded. A total of 711,000 tons of coal was wet-washed, and 530,000 tons was cleaned using pneumatic methods.

Production of clay increased 18 percent and, although the value declined 18 percent, Clearfield remained the leading clay-producing county in the State. Twelve companies operated 28 clay operations, both underground mines and open pits, near Bigler, Curwensville, Clearfield, Wallaceton, Osceola Mills, and Boardman, and in Boggs and Woodward Townships. Most of the clay produced was plastic fire clay, sold or used for manufacturing firebrick and block, building brick, vitrified sewer pipe, and refractories. Some flint fire clay was sold and used for making firebrick and block, and miscellaneous clay was used for making building brick.

Sand and gravel was produced from pits throughout the county for use as aggregate and in the manufacture of concrete block.

Clinton.—Bituminous coal was mined from four underground mines and six strip mines, one less strip mine than in 1958. Strip mines used 18 power shovels and 8 draglines to produce 624,000 tons of coal. Only one cutting machine was used in the underground operations, and none of the production was mechanically loaded. Only 26 percent was mechanically cleaned.

Lycoming Silica Sand Co. crushed and sized limestone for use as concrete aggregate, roadstone, and railroad ballast. Most of the stone was transported by truck and the remainder by railroad.

Miscellaneous clay mined under contract for Mill Hall Clay Products, Inc. (Castanea) was used for manufacturing heavy clay products. Kelsey Mining Co. (Lock Haven) produced diaspore-type clay and sold it for manufacturing high alumina brick.

Columbia.—Output of anthracite declined. Anthracite was mined from strip pits, underground mines, and culm banks. Leading producers were: Raven Run Coal Co., Jeddo-Highland Coal Co., and Locustdale Mining & Contracting Co.

Bloomsburg Sand & Gravel Co. (Bloomsburg) recovered sand and gravel for use as building material.

Miscellaneous clay was recovered from an open pit near Mifflinville by The Alliance Clay Product Co., on property leased from Lloyd E. Eister. Output was used for making heavy clay products.

Crawford.—Sand and gravel produced by four operators was sold to local and State governments and local consumers for use as ready-mix and bituminous material, antiskid and fill material, and other building uses.

Cumberland.—Valley Quarries, Inc., Shippensburg; Hempt Bros., Inc., Camp Hill; and Locust Point Stones Quarries, Mechanicsburg all reported output of crushed limestone for use as concrete aggregate, roadstone, and screenings. In addition, the latter company produced some limestone for agricultural purposes. All the limestone was shipped by truck.

Three companies (Hempt Bros., Inc., C. & L. Goodhart, and R. A. Bender & Son) processed sand and gravel and sold it for building and road paving use.

Philadelphia Clay Co. mined kaolin from an open pit near Mount Holly Springs and crushed and sold the clay for making white portland and other hydraulic cements.

Dauphin.—Hempt Bros., Inc., Camp Hill; and George E. Ebersole & Sons, High Spire, quarried and crushed limestone solely for use as concrete aggregate and roadstone. In addition to producing limestone for road material, the Bethlehem Limestone Co., Steelton quarry, produced limestone for blast-furnace flux and railroad ballast. Crushed basalt for road material was produced near Elizabethville by Faylor Lime & Stone Co. Some of the stone was sold to the Pennsylvania Department of Highways for road construction.

Anthracite was mined at strip pits, and slightly smaller quantities were obtained from culm banks and underground mines.

Glen-Gery Shale Brick Corp. (Royalton and Harrisburg) produced shale for use in manufacturing building brick. Bethlehem Limestone Co., Steelton quarry (Steelton), produced miscellaneous clay marketed for use in making foundry refractories and protective coatings for underground pipelines.

The entire output of sand and gravel by Highspire Sand & Gravel Co., Ltd., (High Spire) and Pennsylvania Supply Co. (Amity Hall) was used for paving.

H. E. Millard Lime & Stone Co. burned hydrated lime at its eight-shaft-kiln Swatara plant near Hershey. Output was sold for agricultural purposes.

Delaware.—Delaware County was by far the leading basalt producing county in the State, with tonnage showing a slight decrease and value a slight increase. V. DiFrancesco & Sons, Freeborn quarry (Havertown), Llanerch quarry and crusher (Llanerch), and General Crushed Stone Co., Glen Mills quarry produced and crushed basalt for concrete aggregate and roadstone. Dimension sandstone for rough construction was quarried by Media Quarry Co. (Media). Carl Galantino, Inc., quarried dimension miscellaneous stone used as rough and dressed construction stone and rubble. DiBonaventura Quarries, Inc., quarried dimension miscellaneous stone for use as rough and dressed construction stone. Three granite quarries near Lima, Broomall, and Swarthmore yielded dimension granite chiefly for use as rough and dressed construction stone, rough architectural stone, and rubble.

Perlite Products Corp. expanded perlite at its Primos plant. The material was sold or used chiefly as a building plaster aggregate and as a mix with asphalt for insulating material.

Elk.—Bituminous coal was produced at 19 underground mines (16 in 1958), 7 strip mines (8 in 1958), and 2 auger mines (3 in 1958). Slightly more coal was produced from underground operations than from strip mines. Of the coal mined underground, 88 percent was cut by machine and 77 percent was mechanically loaded. Of the total county production, only 8 percent was mechanically cleaned; wetwashing methods were used.

Saint Mary's Sewer Pipe Co. mined plastic fire clay near Saint Marys. Output was used by the company for making vitrified sewer pipe.

Stone Haven Mix (Johnsonburg) prepared paving gravel for use on local and State government projects.

Speer Carbon Co. (St. Marys) manufactured graphite (artificial) for use by major steel and chemical companies.

Erie.—Four companies reported output of sand and gravel. Output increased 73 percent over 1958. Processed material was transported from plants by rail and truck.

Reed-sedge and humus peat were recovered from a bog in the southeastern area of the county (near Corry) by Corry Peat Products Co.

Fayette.—Bituminous coal was produced at 41 underground mines, (35 in 1958); 31 strip mines (30 in 1958); and no auger mines (1 in 1958). Forty-nine cutting machines and 43 loading machines were used at the underground operations, with 95 percent cut by machines and 77 percent loaded mechanically. Three draglines, 35 power shovels, and 29 bulldozers were used at the strip operations. Thirty-four percent of the total production from all mines was mechanically cleaned, using both wetwash and pneumatic methods.

Vesco Corp. crushed, ground, and sized limestone recovered from the Lake Lynn quarry and marketed the stone for road material, dust for coal mines, and agricultural purposes. Connellsville Bluestone Co. quarried and crushed sandstone (bluestone) near Scottdale for road material. General Refractories Co. produced crushed and ground ganister rock at the Childs quarry and plant near Layton for making silica brick.

Although the number of operations decreased from four to three, production from open-pit clay operations increased. Plastic and flint fire clay was sold or used for making firebrick and block; miscellaneous clay was sold or used mainly for building brick. Pits were near Ohiopyle, Uniontown, and Layton.

McClain Sand Co., Inc., transported prepared sand and gravel by railroad, truck, and waterway. Part of the prepared gravel was shipped across the State line for use by the West Virginia State agency.

Forest.—Tionesta Sand & Gravel, Inc., sold washed, screened, or otherwise prepared sand and gravel from a stationary plant at Tionesta.

Franklin.—Six active producers reported output of limestone from seven quarries near Shippensburg, Williamson, Zullinger, Chambersburg, and Dry Run. The limestone was used chiefly for concrete aggregate and roadstone. Smaller quantities were sold for use as railroad ballast and for agricultural purposes.

Combined output of three sand companies increased slightly. Sand was washed, screened, or otherwise prepared for building purposes.

Quicklime, solely for agricultural lime, was burned at the 3-shaft-kiln plant of Frank L. Heinbaugh near Mercersburg.

Fulton.—H. B. Mellot Estate, Inc., operated the Charleton quarry and plant (Warfordsburg), producing crushed and broken limestone for use as concrete aggregate, roadstone, and for agricultural purposes. The company's Morton quarry near Big Cove Tannery was idle, but limestone was sold from stock as road material. John P. Martz & Son quarried and crushed limestone solely for manufacturing lime at its Martz Draw kiln near Hustontown.

H. B. Mellot Estate, Inc., processed only sand, near McConnellsburg, for use as building and paving sand by contractors and other users.

Greene.—Greene was the leading county in the production of bituminous coal from underground mines; production totaled 9.6 million tons. Nineteen underground mines were active in 1959, 3 less than in 1958. All but a small fraction of the underground production was cut by machine and loaded mechanically. Three strip mines also were active, using 2 power shovels and 3 bulldozers. Seventy-six percent of the county production was mechanically cleaned, using jigs, other wet methods, and pneumatic procedures.

Huntingdon.—Huntingdon County ranked third in the value of sand and gravel produced in the State. With Alexandria Fire Clay Co. making only a small shipment from stock in 1959, Pennsylvania Glass Sand remained the sole producer of industrial and ground sands.

Limestone recovered from the Orbisonia and McConnellstown operations of New Enterprise Stone & Lime Co. was crushed for use as concrete aggregate and roadstone. The Union Furnace quarry and plant of Warner Co., Bellefonte Division (Union Furnace), produced crushed limestone for use as concrete aggregate, roadstone, and riprap. Tyrone Lime & Stone Co., a former operator in the county, sold its Stover No. 1 quarry in the summer of 1958. North American Refractories Co. (Three Springs) and Harbison-Walker Refractories Co. (Mount Union) quarried and crushed quartzite for making silica brick at the local company plants.

A total of 62,000 short tons of bituminous coal was produced at nine underground mines (seven in 1958) and five strip mines (four in 1958). Only 22 percent of the underground tonnage was cut by machines and 6 percent mechanically loaded. Three power shovels and one dragline were used at the five strip mines. None of the production from underground mines or strip mines was mechanically cleaned.

Plastic fire clay, sold for making refractory mortar, was recovered near Alexandria.

Indiana.—Production from 83 underground mines, 33 strip mines, and 3 auger mines totaled 6.2 million tons of bituminous coal. Indiana was the third-ranking producer of coal from underground mines. One hundred and forty-two cutting machines and loading machines were used. Virtually all of the underground production was mechanically cut and loaded. At the 33 strip mines, 61 power shovels, 24 draglines, and 60 bulldozers were used. Sixty-five percent of the total output was mechanically cleaned, using jigs, other wet methods, and pneumatic methods.

Hiram Swank's Sons, Inc., mined plastic fire clay from its No. 6 underground mine near Clymer. The material was used to make pouring-pit refractories.

Jefferson.—Bituminous coal was produced from 30 underground mines (39 in 1958), 29 strip mines (28 in 1958), and 4 auger mines (3 in 1958). At the underground mines, 81 cutting machines and 46 loading machines were used; 94 percent of the coal was mechanically cut, and 74 percent of the coal was mechanically loaded. Only 9 percent of the county production from underground, strip, and auger mines was mechanically cleaned. Only jigs were used to clean the coal.

Henry O'Neill & Co., at an underground mine near Brookville, produced flint fire clay marketed for use in making firebrick and block. The Brockway Clay Co. (Brockway) and Hanley Co. (Summerville) also operated underground mines but produced plastic fire clay used at the company plants to make building brick, tile, vitrified sewer pipe, and other heavy clay products.

Juniata.—W. N. Quigley quarried limestone and crushed it in a portable plant near Mifflin for use as road material. Juniata Limestone Co., McAllisterville, produced crushed limestone for road material and agricultural purposes. Both companies sold stone to local and nearby government agencies for road construction. Fulkroad Lime Quarry, McAllisterville, produced crushed limestone solely for use in manufacturing lime. Kaiser Aluminum & Chemical Corp. recovered quartzite and crushed and used it at the Van Dyke plant (Thompsontown) to manufacture silica brick.

Quicklime was produced at the 3-pot-kiln plant of Fulkroad Lime Quarry, McAllisterville. The lime was used for agricultural purposes on farms in Juniata, Snyder, and Perry Counties.

Lackawanna.—Output of anthracite increased slightly compared with 1958, but average value per short ton dropped from $9.62 in 1958 to $9.28 in 1959. Underground mines, strip pits, and culm banks were operated. Leading producers were Hudson Coal Co. and Moffat Coal Co.

Lancaster.—Production and value of dimension limestone remained the same. The limestone was produced mainly for use as rough construction stone. The tonnage and value of crushed and broken limestone increased 34 and 24 percent, respectively. Sixteen quarries and plants were operated by 14 companies near Gap, Rheems, Quarryville, Talmage, Lititz, Denver, Morgantown, Blue Ball, Salunga, Bareville, Bainbridge, Martindale, and East Petersburg. Leading producers were D. M. Stoltzfus & Son, Inc., Bradford Hills Quarry, Inc., and Ivan M. Martin, Inc. Most of the crushed stone produced was sold or used for concrete aggregate and roadstone; smaller quantities were used for agricultural purposes, stone sand, manufacture of lime, and asphalt fill. Much of the limestone was sold under contract to local and nearby government agencies for road construction, and some was sold for agricultural uses.

Anthracite was recovered by dredging operations.

Two companies, Milton Grove Sand, Inc. (Milton Grove) and Hempt Bros. (Elizabethtown), operating stationary plants, processed building sand, and A. T. Harris Sand Co. produced industrial sand at its Honey Brook plant.

The J. E. Baker Co. produced dead-burned dolomite as refractory material at its 2-rotary-kiln Billmeyer plant near Bainbridge. Quicklime for agricultural uses and hydrated lime as building lime were produced near Elverson by Amos K. Stoltzfus.

Whitaker Clay Co. mined plastic fire clay near Narvon and sold it for use in foundries and steelworks. Miscellaneous clay and shale were mined to make building brick by Glen-Gery Shale Brick Corp. (Ephrata) and Lancaster Brick Co. (Lancaster).

Mineral specimens and gem-quality stones were collected near Blue Ball and in Fulton Township. Included among the specimens and stones were eucryptite, hydromagnesite, goethite, calcite, pyrite, and malachite.

Lawrence.—Shipments and value of portland cement increased slightly (4 and 3 percent, respectively). Bessemer Limestone & Cement Co. utilized captive cement rock at its Bessemer plant to manufacture Types I–II air-entrained and non-air-entrained and some Type III non-air-entrained portland cement. Mortar cement also was produced. Three 235- x 10-foot rotary kilns and one 450- x 12-foot kiln were operated. Medusa Portland Cement Co. (Wampum) produced general-use and moderate heat, also high-early-strength portland cements and some masonry cement. Two 390- x 12-foot rotary kilns were operated. Shipments of cement were largely in bulk by truck, mainly to ready-mixed concrete companies and building material dealers.

Lawrence County dropped from third to fifth among the stone-producing counties. Five companies produced crushed limestone and cement rock, mainly for blast-furnace flux, cement, concrete aggregate, and roadstone. The stone was recovered from quarries near Bessemer, Wampum, Hillsville, New Castle, and Mahoning Township. Most of the stone was transported by rail.

One underground bituminous coal mine (2 in 1958) and 28 strip mines (24 in 1958) were active in 1959. Thirty-eight power shovels, 18 draglines, and 25 bulldozers were used at the strip mines. None of the coal mined in Lawrence County was mechanically loaded.

Output of clay increased 19 percent in tonnage and 29 percent in value. Plastic fire clay and miscellaneous clay for building brick and other heavy clay products were produced at Enon Valley, Edinburg, New Castle, and Bessemer.

Sand and gravel recovered by Mahoning Valley Sand Co. was processed at the local plant for use as construction and paving material. Sand was produced for filtration and gravel for fill. Superior Sand & Supply Co. also produced sand and gravel.

D. M. Boyd produced humus peat from bogs near Leesburg. Moore's Humus & Nursery recovered reed-sedge peat at a bog in Washington Township.

Lebanon.—The Cornwall iron ore mine, 5 miles south of Lebanon, was operated by Bethlehem Cornwall Corp., a subsidiary of Bethlehem Steel Co. Mining was 98 percent by block caving and 2 percent by the open stope method. Crude ore was processed at the Lebanon concentrator by flotation, magnetic concentration, and agglomeration.

Lebanon County was second in lime production. H. E. Millard Lime & Stone Co. operated 4 rotary kilns and 1 continuous hydrator to produce quicklime and hydrated lime at its Annville plant. Some quicklime was sold for agricultural purposes, and quicklime and hydrated lime were sold for building, metallurgical, water purification, and papermaking uses. The company's Palmyra calcining plant was idle.

Four limestone quarries were operated by three companies. Crushed and broken stone was sold or used principally for use as concrete aggregate and roadstone, in the manufacture of cement and lime, and as open-hearth flux. Smaller quantities were sold for agricultural purposes and railroad ballast. Pennsylvania Aggregates, Inc., Cornwall, did not operate its quarry but sold limestone from a stockpile to local government agencies for use as road material. The Fiala, Inc., White Hall quarry and plant discontinued operations due to the depletion of its limestone deposit.

Anthracite was recovered by dredging operations.

Lehigh.—Although one less cement plant operated in the county (five in 1958), shipments increased slightly. General use, moderate heat, high-early-strength, air-entrained, and non-air-entrained portland cements were produced near Coplay, Cementon, Fogelsville, and Egypt. Some mortar cement also was produced. All the material was shipped by railroad, mostly in bulk. Giant Portland Cement Co., Egypt, completed a new closed-circuit ray-milling department. The old raw mills were being converted for use in cement finishing.

New Jersey Zinc Co. (Friedensville) mined crude zinc ore at its Friedensville underground mine. The room and pillar method was used. Zinc concentrate was shipped by truck about 25 miles to the company smelter at Palmerton.

Output of cement rock by Lehigh Portland Cement Co., Fogelsville; Giant Portland Cement Co., Egypt; The Whitehall Cement Manufacturing Co., Cementon; and Coplay Cement Manufacturing Co., Coplay, was crushed at local plants and utilized solely for manufacturing cement. Lehigh Stone Co., Ormrod, produced crushed and broken limestone for use as concrete aggregate and roadstone. Some of the stone was sold to nearby government agencies for road construction. Quarries of Lehigh Portland Cement Co. at Ormrod and Susquehanna Quarry at Allentown were not operated. Penn Big Ben Slate Co., Inc., Slatington, quarry No. 2, produced and processed slate chiefly for structural and sanitary uses, standard roofing, blackboards, and bulletin boards.

Linarite, jasper, corundum, chalcedony, and zinc mineral gem-quality specimens were collected.

Pennsylvania Perlite Corp. (Allentown) expanded perlite shipped from mines in Colorado. The material was marketed mainly as a building plaster aggregate.

Luzerne.—Luzerne County was second in anthracite production. Output totaled 6,158,000 short tons, of which 77 percent was shipped outside the producing region, 22 percent was sold to local trade, and 1 percent was consumed for colliery fuel. Strip pits, underground mines, and culm banks were operated. Leading producers were: Glen Alden Corp., Hudson Coal Co., and Jeddo-Highland Coal Co.

Six plants (five stationary and one portable) washed, screened, or otherwise prepared sand and gravel as building and paving material. Output of sand and gravel increased slightly over 1958. More than 25 percent of the output was purchased by governmental agencies.

Four sandstone producers operated quarries at Chase, Sweet Valley, White Haven, and in Jenkins Township. The output was crushed and sold or used as road material and riprap. Hayes Bros. Stone Co. (White Haven) discontinued business in 1958.

Luzerne County was the leading peat-producing area in the State, and output increased slightly. Blue Ridge Soil Pep Co. recovered humus peat from a bog near White Haven. Pennsylvania Peat Moss, Inc., produced reed-sedge, moss, and humus peat from bogs near White Haven.

Miscellaneous clay for making building brick was mined by Hazleton Brick Co. (Hazleton).

Lycoming.—Lycoming Silica Sand Co., Lime Bluff quarry (Muncy) and Pine Creek quarry (Jersey Shore) produced crushed and broken limestone for use as road material. In addition, limestone from the Pine Creek quarry was crushed for agricultural purposes. John T. Morgan (Slate Run), a former sandstone producer, discontinued business in 1958. Keystone Filler & Manufacturing Co., at its Sheddy quarry near Muncy, produced, crushed, and ground slate for use as flour. Callahan & Haines Stone Co. (Slate Run) produced dimension miscellaneous stone for flagging stone and rubble.

The production of J. A. Eck & Sons, Inc., and Lycoming Silica Sand Co. again placed Lycoming County third in sand and gravel output. In addition to the sand and gravel produced for paving and construction needs, sand was utilized as industrial sand.

Bituminous coal was produced from three underground and two strip mines. The entire production from underground mines was produced by hand methods. At the strip mines, 38 power shovels and 18 draglines were used. None of the coal produced was mechanically cleaned.

Tripoli (rottenstone) was quarried by Keystone Filler & Manufacturing Co. at the Sheddy quarry (Muncy) and by Penn Paint & Filler Co. at the Ramsey quarry (Antes Fort). The crude material was crushed, dried, and ground for use as an abrasive and filler.

McKean.—Fire clay was recovered from pits near Mount Jewett and Clermont for making refractories for foundries and steelworks and hot tops for steel mills. Shale for building brick and floor and wall tile was mined near Lewis Run.

Three strip mines produced 42,000 short tons of bituminous coal. Eight power shovels, 1 dragline, and 8 bulldozers were used in the strip mines. None of the coal produced was mechanically cleaned.

C. L. McGavern, Jr., recovered molding sand from an open-pit mine. The entire quantity was transported by truck.

Mercer.—Three underground and seven strip mines were active in 1959, with 92 percent of the bituminous coal coming from the strip mines. Five cutting machines and one loading machine were used in the underground mines; all of the output was cut by machine, and 23 percent was loaded mechanically. None of the coal was mechanically cleaned.

Four companies produced sand and gravel from pits near West Middlesex, Mercer, Sharon, and South Pymatuning Township. Most of the sand and gravel was washed and screened and used chiefly for building and paving material. Smaller quantities were used for fill sand and miscellaneous uses. Transportation to consumers was by truck.

The Rock Kastle quarry (north of Volant), operated by Welty M. Smeltzer, yielded dimension sandstone for building mantels. White Rock Silica Sand Co. (Greenville) quarried and crushed silica chiefly for use in foundries and as road material.

Mifflin.—Pennsylvania Glass Sand Corp. produced industrial sand at the Hatfield Works near McVeytown for grinding, polishing, glass-molding, engines, and other uses. Miller Silica Sand Co. (Burnham) and James R. Kline's Sons (Lewistown) processed building, molding, and engine sand. Railroads and trucks transported the sand to consumers.

Bethlehem Limestone Co. mined limestone for blast-furnace and open-hearth flux, road material, and railroad ballast from the Naginey quarry (Naginey). Honey Creek Lime Co. (Reedsville) and Ehrenzeller Lime Co. (McVeytown), produced and crushed limestone for use in manufacturing lime. Haws Refractories Co. mined quartzite at the Hawstone quarry (Hawstone) and used it at the company plant for manufacturing silica brick.

Honey Creek Lime Co. (Reedsville) produced and sold hydrated lime for agricultural purposes, operating a 10-pot kiln and a continuous hydrator. Ehrenzeller Lime Co. burned and sold quicklime as agricultural lime at its 7-draw-kiln plant near McVeytown.

Monroe.—Hamilton Stone Co. produced crushed limestone at its Bossardsville quarry and plant for use in manufacturing lime and as an asphalt filler. Some of the stone was sold to the Pennsylvania Department of Highways for road construction.

The combined output of structural sand and gravel prepared by Steward White & Clyde White (Stroudsburg) and Sheesley Minerals, Inc. (Kunkletown) was transported by truck to consumers.

Various crystal gem specimens were collected, principally near Stroudsburg.

Montgomery.—Allentown Portland Cement Co. produced Types I-II general-use and moderate-heat, also air-entrained, and non-air-entrained portland cements and masonry cement from captive limestone and cement rock at its No. 2 plant at West Conshohocken. Three rotary kilns were operated. The material was shipped by rail, mostly in bulk, chiefly to ready-mix concrete companies.

Montgomery County continued to rank second among the stone-producing counties in the State. Tonnage and value rose slightly. Two operators near Norristown and Conshohocken produced crushed and broken limestone for use as concrete aggregate and roadstone. Two quarries, operated near Bridgeport and Plymouth Meeting, yielded limestone chiefly for open-hearth and blast-furnace flux, concrete aggregate, road material, agricultural purposes, and cement and lime manufacture. Thirty-six percent of the stone was transported by rail, 59 percent by truck, and 5 percent by unspecified means. Montgomery Stone Co., Inc., Montgomeryville, produced dimension basalt as dressed structural stone and crushed basalt for road material. R. K. Kibblehouse quarried and crushed basalt for road material near Perkiomenville. Some of the stone was sold to local and nearby government agencies for road construction.

Irregular-shaped rough construction dimension sandstone was quarried by Wm. Bambi & Sons, Inc., (Norristown). Fire Stone Products Co. (Glenside) quarried dimension sandstone and crushed some for use as refractory lining in steel-producing furnaces. Irvin B. Gill (East Norriton Township) produced crushed sandstone for road material. Crushed and broken miscellaneous stone (argillite) was quarried near Harleysville by M. & M. Stone Co. and used for road material. Dimension miscellaneous stone (mica schist), for rough and dressed building stone, was quarried and marketed by A. Manero & Sons, near Glenside. The Hillcrest quarry north of Chestnut Hill, operated by Marcolina Bros., Inc., yielded dimension granite utilized by the company for use as rough construction stone.

Total production of lime rose 8 percent in tonnage and 25 percent in value. G. & W. H. Corson, Inc. (Plymouth Meeting) produced building lime, quicklime for refractories and chemical uses, and hydrated lime chiefly for chemical and industrial uses.

The Keller-Whilldin Pottery Co. (North Wales) clay pit was idle, but the company manufactured art pottery, flower-pots, and glaze slips from stocks of clay. Robinson Clay Product Co. (Pottstown) used its output of plastic fire clay and miscellaneous clay for making vitrified sewer pipe. Norristown Brick Co. (Norristown) produced miscellaneous clay for making building brick. Philadelphia Brick Co. (Trappe) used shale to manufacture draintile and flues.

Prepared structural sand was produced by William Bambi & Sons, Inc., at its stationary plant near Norristown.

Audubon, Miquon, and Eureka were the principal areas where gem stones and mineral specimens were found. Among the specimens collected were garnet, almandine, galena, quartz, calcite, pyrite, anglesite, and copper and lead minerals.

Crude perlite, from mines in Colorado, Utah, and Pennsylvania, was expanded by Refractory & Insulation Corp. (Port Kennedy) and Philip Carey Manufacturing Co. (Plymouth Meeting). The expanded material was marketed for use as a filler and insulation material.

Montour.—Lycoming Silica Sand Co. (Milton) quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Mausdale Quarry Co. (Danville) quarried and crushed limestone for use as concrete aggregate and roadstone. Some of the stone was sold to local government agencies for road construction.

Northampton.—Northampton County remained the leading cement-producing area in the State. The quantity and value of cement, which had dropped the two previous years, increased 2 and 7 percent, respectively. Ten companies operated 12 plants, manufacturing cement from captive limestone and cement rock and from materials purchased from outside sources. General-use and moderate-heat, also high-early-strength, portland and masonry cements were produced. Most of the cement was shipped by rail, in bulk, mainly to ready-mix concrete companies and manufacturers of concrete products. Plant operations were near Martins Creek, Northampton, Stockertown, Bath, Sandts Eddy, Bethlehem, and Nazareth. Nazareth Cement Co. (Nazareth) added a new crushing plant which began operating in September. Keystone Portland Cement Co. (Bath) reportedly renovated four 250-foot kilns, purchased two new quarry shovels, and installed a new secondary crusher in the crushing plant. National Portland Cement Co. (Bethlehem) installed cement storage silos for direct loading into trucks.

Northampton County continued to be the leading stone-producing area in the State, with increases in tonnage and value of 4 and 7 percent, respectively. Twelve firms produced limestone and cement rock from 13 quarries: 4 near Nazareth, 2 near Northampton, 2 near Bath, 2 near Bethlehem, and 1 each near Martins Creek, Stockertown, and Sandts Eddy. Most of the limestone and cement rock was utilized at the company plants for manufacturing cement, as concrete aggregate, and as roadstone. Smaller quantities were used for railroad ballast and stone sand. Northampton continued as the leading slate-producing county in the State, and output remained virtually the same as in 1958. Slate was quarried at 11 operations: 6 near Pen Argyl, 2 near Bangor, and 1 each near East Bangor, Bath, and Windgap. The slate was processed and marketed chiefly for flagging stone, roofing slate, structural and sanitary uses, and blackboards and bulletin boards.

Output of prepared sand and gravel, chiefly as building and paving material, was reported by W. J. Lowe & Sons, Inc. (Bangor) and Houdaille Construction Materials, Inc. (Portland). All the material was shipped to consumers by truck.

Anthracite was recovered by dredging operations.

Small quantities of bowenite and linarite gem specimens were collected.

Northumberland.—Average value of anthracite dropped to $7.15 per short ton from $7.73 in 1958. Leading producers were Reading Anthracite Co. and Susquehanna Collieries Co. Strip pits, underground mines, and culm banks were active.

Output of clay remained about the same. Two clay operators near Watsontown used the miscellaneous clay and shale output to make building brick. Watsontown Mineral Products Co. (Watsontown) used its stock of miscellaneous shale as a filler in linoleum.

Limestone, quarried by Eugene Meckley at the Meckley's quarry near Herndon, was crushed and broken for concrete aggregate, roadstone, and agricultural purposes. Transportation of all stone was by truck.

Prepared industrial molding sand was reported by M. E. Wallace Co. (Danville). Structural and fill sand was prepared by Wilsons Sand Plant (Montandan).

Clyde Starook (Northumberland) burned quicklime for agricultural purposes in a pot kiln using anthracite as fuel. The lime was delivered to customers within a 50-mile radius.

Perry.—Limestone was quarried near Newport by Bradford Hills Quarry, Inc., and crushed for use as concrete aggregate and roadstone. Some of the stone was sold to local government agencies for road construction.

Philadelphia.—The Liberty Corp. dredged and prepared structural sand and gravel along the Delaware River near Philadelphia. Transportation to consumers was by barge.

A small quantity of dolomite was collected by a hobbyist for gem specimens.

Potter.—Penn Kress Flagstone Co., Inc., (Wharton) reported output of dimension sandstone for use as irregular-shaped construction stone, rough architectural blocks, and flagging stone. Carroll M. Winseck, a new producer in the county, reported output of dimension miscellaneous stone near Roulette for use as flagging and rough and dressed building stone.

Schuylkill.—Schuylkill again led all counties in output of anthracite, accounting for 38 percent of the State tonnage and value. Average value per short ton dropped to $8.16 from $8.64 in 1958. Leading producers were: Reading Anthracite Co., Gilberton Coal Co., Valley Stripping Corp., and Mammoth Coal Co. Underground mines, strip pits, and culm banks were operated.

Huss Contracting Co. produced crushed limestone at the Andreas quarry (Andreas) for use as concrete aggregate and road material. Some of the stone was sold to the Pennsylvania Department of Highways for road construction. Quartzite, quarried and crushed for use in manufacturing silica brick, was produced at the Andreas quarry (Andreas) by Harbison-Walker Refractories.

Paving and fire or furnace sand was recovered from a pit near Andreas by Refractory Sand Co., Inc.

Coaldale Mining Co., Inc., sold miscellaneous clay, from its pit near Coaldale, for use in making lightweight aggregate. Auburn Brick Co. used miscellaneous clay, from a pit near Auburn, for making building brick.

Snyder.—Dredging was the only method of obtaining anthracite.

Miscellaneous clay and shale from two pits near Beavertown and Paxtonville, was used in manufacturing building brick.

National Limestone Quarry, Middleburg, quarried and sold crushed limestone for road material and agricultural purposes. Carton L. Comfort quarried and crushed limestone near Mount Pleasant Mills for use in manufacturing lime. Quicklime for agricultural purposes was burned at the local company lime plant.

Somerset.—Somerset County again had the most active underground bituminous coal mines with 103 (12 less than in 1958). Underground production totaled 948,000 short tons; 82 percent was mechanically cut, and 49 percent was mechanically loaded, using 165 cutting machines and 82 loading machines. Approximately 11 percent of the county production was mechanically cleaned, using wetwashing and pneumatic methods. Eighty power shovels and 35 draglines were used to produce 1.1 million tons of strip coal at the 54 active mines. Two auger mines also were active.

Somerset County clay production and value increased 39 and 31 percent, respectively. Four companies produced fire clay from open pits for use at company-owned plants making building brick, firebrick and block, and refractories such as sleeves, nozzles, and stoppers.

Keystone Lime Co., Springs, quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes. Somerset Limestone Co., Inc., Bakersville, quarried limestone for road material.

Small quantities of sand for various uses were recovered by Robert D. Shaulis and Boswell Sand Co. (both near Boswell).

Sullivan.—Anthracite was mined at strip pits, underground mines, and culm banks. Pastusic Bros. Coal Co., the leading producer, operated the White Ash Slope underground mine.

Susquehanna.—Dimension sandstone (bluestone) was recovered from eight quarries near Harford, Brooklyn Township, north of Nicholson, Lakeside, New Milford, and Givson. The principal use of the sandstone was for flagging stone. Some of the sandstone was used for rough and dressed construction stone and rubble. Keelor Supply Co., Inc., produced crushed sandstone, at the Bennett quarry near Clifford, for use as road material.

Susquehanna Quarry Co. produced and prepared structural gravel, at a pit and portable plant near Union Dale, for construction of a flood-control dam in the vicinity.

Tioga.—Five underground mines and nine strip mines produced bituminous coal, compared with five underground mines and three strip mines in 1958. Nine draglines and 15 power shovels were in use at the strip mines.

Dimension sandstone for use as flagging stone and rubble was quarried in Elk Township by Lyle R. Robinson.

Union.—Crushed limestone was produced by John L. Iddings, near Mifflinburg, and marketed as road material. Faylor Lime & Stone

Co., Winfield, quarried and crushed limestone for concrete aggregate, roadstone, and agricultural purposes.

Venango.—Production from 13 strip mines (1 less than in 1958) totaled 552,000 short tons of bituminous coal. Three draglines and 16 power shovels were used at the strip mines. Fifty-four percent of the coal mined was mechanically cleaned, using jigs.

Industrial Silica, Division of Pennsylvania Glass Sand Corp. recovered and processed industrial molding and fire or furnace sand near Utica. White City Sand & Gravel (south of Titusville) and Oil City Sand & Gravel Co. (Oil City) reported output of sand and gravel chiefly as building and paving material and fill gravel. Some of the material was sold to local government agencies for road stabilization.

Warren.—Sand and gravel was recovered by dredging along the Allegheny River near Starbrick by General Concrete Products Corp. The material was processed for structural and paving uses and shipped to consumers by truck. Nelson & Ellberg (Warren) produced building sand and gravel and fill gravel near Warren.

Washington.—Washington County led in total production and underground production of bituminous coal. Twenty-three underground mines (1 less than in 1958) were active in 1959; most of the coal was mechanically cut and mechanically loaded. Twenty-one strip mines produced 975,000 short tons of coal. Nine draglines, 41 power shovels, and 37 bulldozers were used at the strip mines. Ninety-four percent of the county production was mechanically cleaned, using wet-washing methods.

Miscellaneous clay and red shale recovered from two open pits near Washington, and one near Monongahela were used at local company plants for making building brick.

Wayne.—Sandstone (bluestone), quarried and crushed by Wayne Concrete & Sand Works, Inc., near Damascus and Lake Ariel, was used mainly as road material, with a smaller quantity used as riprap. W. R. Strong & Son and Paul Thompkins Estate quarried dimension sandstone mainly for use as flagging stone, dressed or cut stone, and rubble.

The Lake Ariel operation of Wayne Concrete & Sand Works was idle, but the company sold structural sand and gravel from its stockpile. Keystone Paving (Lake Ariel) produced and processed paving sand and gravel.

Wayne Peat Moss Co. recovered humus peat from bogs at the southern tip of the county near Gouldsboro.

A small amount of anthracite was mined. Most of the output was sold locally.

Westmoreland.—Fifty-nine underground mines (7 less than in 1958), 23 strip mines (6 more than in 1958), and 2 auger mines (1 more than in 1958) were active. A major portion of the bituminous coal mined underground was cut and loaded mechanically. A total of 24 power shovels and 2 draglines were used at the strip mines to produce 160,000 tons of coal.

Latrobe Construction Co. produced crushed basalt near Long Bridge as road material and for making concrete blocks. John C. Beaumont (Smithton) and Ray Branthoover (north of Belle Vernon) produced dimension sandstone for rubble. Clayton H. Remaley (Export) and Eidemiller Enterprises, Inc., Blue Rock quarry (Lycippus) quarried and crushed sandstone as road material. Lynn's Quarry (north of Belle Vernon) yielded dimension miscellaneous stone for use as flagging stone.

Westmoreland Clay Products Co. (Youngwood), the only clay producer in the county, closed permanently because the Greensburg-By-Pass road was constructed through its property.

Wyoming.—Three sand and gravel operators near Falls, Tunkhannock, and Falls Township produced building and paving sand and gravel, gravel for fill, and engine sand. All the material was transported to consumers by truck.

J. G. Robinson Inc. reported output of dimension standstone (bluestone) for use as flagging.

York.—Medusa Portland Cement Co. remained the only cement producer. Six rotary kilns were operated at the York plant to produce waterproof white and gray portland cements and mortar cements. Eighty-one percent of the cement was shipped by rail, and the remainder by truck, mostly in bulk.

York County ranked third in the State in tonnage and value of stone production. Limestone was produced at nine operations: six near York, and one each near Mount Wolf, Wrightsville, and Thomasville. Most of the limestone was crushed and broken for use as concrete aggregate, roadstone, open-hearth and blast-furnace flux, agricultural purposes, cement and lime manufacture, and railroad ballast. Crushed and ground slate at the Delta open quarry and plant of The Funkhouser Mills, Division of The Ruberoid Co. was marketed as natural granules and flour.

Dead-burned dolomite for refractory material was produced at the York plant of J. E. Baker Co. Shipments were mostly to points in Pennsylvania, Maryland, and Delaware. Some of the dead-burned dolomite was exported to Canada, Venezuela, Chile, and Panama.

Production of sand and gravel increased considerably. Three producers, near York, York Haven, and Mount Wolf, produced mostly washed and screened building and paving sand and gravel. Most of the material was delivered to consumers by truck.

Production of clay decreased. Glen-Gery Shale Brick Corp., York Colonial Division (York) reported output of miscellaneous shale used for making building brick. The company's Spring Garden Division (York) operation remained idle.

Mica, processed by air separation, was sold for the following uses: Paint, rubber (mold lubricant), plastics, and welding rods. General Mining Associates (Glenville) was the only mica producer in the State.

Pennsylvania Perlite Corp. expanded perlite at its expanding plant at York.

The Mineral Industry of Puerto Rico, the Panama Canal Zone, the Virgin Islands, and Pacific Island Possessions

The Puerto Rico section of this chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Mineralogy and Geology Section, Economic Development Administration, Commonwealth of Puerto Rico.

By W. G. Diamond,[1] Leovigildo Vazquez,[2] and R. Y. Ashizawa[3]

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PUERTO RICO[4]

MINERAL production in Puerto Rico in 1959 was valued at $19.7 million, over $2 million more than in 1958. Output and value of all minerals were greater than in 1958.

The first exploratory test for oil in Puerto Rico was started during the year. Kewanee Inter-American Oil Co., an affiliate of Kewanee Oil Co. of Philadelphia, Pa., and Tulsa, Okla., operated the venture for a group that included a syndicate of Texas oilmen and bankers. The wildcat well, No. 1 Commonwealth, was drilled on the south coast of Puerto Rico near Santa Isabel. A hole depth of at least 6,000 feet was anticipated.

TABLE 1.—Mineral production in Puerto Rico[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement..........376-pound barrels..	4,747,976	$15,175,498	5,392,312	$16,982,139
Clays..........	165,489	82,745	166,962	83,481
Lime..........thousand short tons..	(2)	(2)	10	321,102
Salt..........	1,400	14,440	2,729	38,354
Sand and gravel..........	475,752	762,546	530,052	887,687
Stone..........	1,985,802	2,767,574	2,063,162	2,878,329
Value of items that cannot be disclosed: Certain nonmetals..........	....	272,191	....	....
Total Puerto Rico[3]..........	....	17,689,000	....	19,700,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] The total has been adjusted to eliminate duplication in value of clays and stone.

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[3] Statistical assistant, Region II, Bureau of Mines, San Francisco, Calif.
[4] Prepared by W. G. Diamond and Leovigildo Vazquez.

Exploration for copper was the highlight of the mineral industry in Puerto Rico in 1959. Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., and Caguas Copper Co. were active. Geological exploration, geochemical surveys, and diamond drilling resulted in several holes showing less than 1.0 percent mineralization over a thickness of several hundred feet. Other mining companies holding mining concessions speeded up their surveys.[5] No commercial mining of metals was reported in Puerto Rico in 1959.

REVIEW BY MINERAL COMMODITIES

Cement.—The cement industry operated at 89 percent of capacity. All cement was produced by the wet process. Cement shipments accounted for over 86 percent of the total value of mineral production in 1959. About 55 percent was shipped in bulk and 45 percent in paper bags. The United States received 29 percent of the shipments and foreign countries 2 percent. The quantity of cement sold in Puerto Rico increased 20 percent over 1958.

Clays.—Clay was used principally in manufacturing cement. Miscellaneous clay was produced near Carolina in San Juan District for manufacturing heavy-clay products. Production of miscellaneous clay increased in 1959.

TABLE 2.—Portland cement produced and shipped in Puerto Rico

Year	Production (barrels)	Shipments	
		Barrels	Value (thousands)
1950–54 (average)	3, 760, 457	3, 760, 568	$9, 814
1955	4, 193, 592	4, 116, 739	12, 507
1956	4, 234, 284	4, 254, 701	14, 065
1957	5, 500, 553	5, 552, 357	17, 232
1958	4, 861, 862	4, 747, 976	15, 175
1959	5, 324, 188	5, 392, 312	16, 982

Lime.—Lime was produced in Humacao and Mayaguez Districts. The output of lime increased over that in 1958, and the raw-sugar industry was the principal market.

Salt.—Salt was produced in Mayaguez District in 1959 by the evaporation of sea water. Quantity and value were much higher than in 1958, when extremely low production was reported.

Sand and Gravel.—Sand for concrete aggregate was produced from rivers and beaches. Large quantities of sand were obtained from the beach area east of San Juan and from two large beach areas at Ramey Air Force Base. Silica sand was produced for use as an abrasive in polishing imported marble and in the glass and ceramic industries.

Stone.—Crushed and dimension limestone and crushed miscellaneous stone were quarried in Puerto Rico in 1959. Crushed limestone was produced in six of the seven districts, dimension limestone in five districts, and miscellaneous stone in one district. Crushed stone was used mainly for aggregate, and dimension stone was used in rough construction and as rubble.

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[5] Mining World, vol. 22, No. 1, January 1960, p. 43; Catalog, Survey and Directory Number, Apr. 25, 1960, p. 127.

TABLE 3.—Stone sold or used by producers in Puerto Rico

Year	Dimension limestone		Crushed limestone [1]		Miscellaneous stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value (thousands)
1955	86,077	$187,842	1,697,833	$2,327,918	----------	----------	1,783,910	$2,516
1956	75,168	142,626	2,001,285	2,412,959	----------	----------	2,076,453	2,556
1957	178,619	356,132	2,225,139	3,084,743	48,261	$64,348	2,452,019	3,505
1958	148,146	281,058	1,777,656	2,351,516	60,000	135,000	1,985,802	2,768
1959	10,322	23,424	1,980,840	2,692,905	72,000	162,000	2,063,162	2,878

[1] Includes limestone for cement and lime.

MINERAL FUELS

Petroleum.—Commonwealth Oil Refining Co., Inc., increased the capacity of its refinery to 79,500 barrels per day, and Caribbean Refining Co. operated its 15,000-barrel-per-day plant. These two plants gave Puerto Rico a total crude capacity of 94,500 barrels a day.[6] Latin-American crude petroleum was processed. Gonzales Chemical Industries, Inc., manufactured anhydrous ammonia and ammonium sulfate at its plant near Guanica. Union Carbide Caribe (unit of Union Carbide Corp.) completed a new petrochemical plant at Ponce to manufacture ethylene glycol. The plant went onstream in mid-1959. Ethylene glycol is a basic ingredient for antifreeze solutions, adhesives, and varnishes. It is also used as a coolant in refrigeration and air conditioning.

REVIEW BY DISTRICTS

Aguadilla.—Limestone was quarried and crushed by General Builders Supplies, Inc., and Rafael Falcon for concrete aggregate and roadstone. A small quantity of dimension limestone also was quarried. The U.S. Army Corps of Engineers and the Department of Public Works, Commonwealth of Puerto Rico, contracted for paving gravel. Production of sand was reported by F. J. Rosello and General Builders Supplies, Inc.

Arecibo.—Cantera de Casanovas crushed limestone for use as aggregate. A small quantity of dimension limestone also was quarried. The Department of Public Works, Commonwealth of Puerto Rico, produced sand for paving.

Guayama.—Limestone and sand and gravel were produced in 1959. David Rodriguez quarried and crushed limestone, and Planta de Grava del Turabo, Inc., produced sand and gravel.

Humacao.—Planta de Cal "Hicaco," Inc., quarried limestone for use in manufacturing hydrated lime. Building sand also was produced.

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[6] Oil and Gas Journal, vol. 58, No. 13, Mar. 28, 1960, p. 170.

TABLE 4.—Value of mineral production in Puerto Rico by districts

District	1958	1959	Minerals produced in 1959 in order of value
Aguadilla	$136,414	$172,992	Stone, sand and gravel.
Arecibo	21,136	22,751	Do.
Guayama	19,200	58,092	Do.
Humacao	501,031	547,670	Lime, stone, sand and gravel.
Mayaguez	294,907	324,920	Stone, salt, sand and gravel, lime.
Ponce	10,824,274	12,324,371	Cement, stone, sand and gravel.
San Juan	5,892,529	6,169,795	Cement, stone, sand and gravel, clays.
Various		79,270	Sand and gravel.
Total	17,689,000	19,700,000	

Mayaguez.—Limestone was quarried and crushed for concrete aggregate and roadstone by Juan del Toro Seda. Cantera Bravo and Eugenio Natali produced dimension limestone. Liborio Lopez Sanchez produced crushed limestone, paving sand, and paving gravel. Sand for building and paving was mined by Playa Ballena and the Department of Public Works, Commonwealth of Puerto Rico. Conrado Forestier quarried and crushed miscellaneous stone for concrete aggregate and roadstone. South Puerto Rico Sugar Co. manufactured lime. Salt was recovered from sea water by Ponce Salt Industries, Salinas del Papayo, Inc., and Carlos M. Ramirez Acosta. Gonzales Chemical Industries, Inc., manufactured anhydrous ammonia and ammonium sulfate at Guanica. Commonwealth Oil Refining Co. operated its refinery.

Ponce.—Portland cement was produced by Ponce Cement Corp. Cement Products Corp. and Ismaro Torruellas quarried and crushed limestone for concrete aggregate and roadstone. Ponce Aggregates Corp. mined sand and gravel from local deposits. Union Carbide Caribe manufactured ethylene glycol.

San Juan.—Puerto Rico Cement Corp. quarried limestone for production of portland cement at its Guaynabo plant. Dimension limestone was quarried by Federico Gonzalez and the Department of Public Works, Commonwealth of Puerto Rico. Crushed limestone was produced by Cantera Diaz, Ramos Hermanos, Inc., Compania de Ing y Contratistas, Francisco Ferrer, the Land Authority of Puerto Rico, and the Department of Public Works, Commonwealth of Puerto Rico. Puerto Rico Clay Products, Inc., mined shale for manufacturing heavy-clay products. Paving sand was mined by Las Vegas Sand & Gravel Corp. and Puerto Rico Aggregate Co. The Department of Public Works, Commonwealth of Puerto Rico, contracted for building and paving gravel. Caribbean Refining Co. operated its petroleum refinery.

PANAMA CANAL ZONE[7]

Production of stone and sand and gravel was reported in the Panama Canal Zone. The value of mineral production rose owing to the increased output of stone.

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[7] Prepared by W. G. Diamond and Leovigildo Vazquez.

TABLE 5.—Mineral production in the Panama Canal Zone and Virgin Islands[1]

Mineral	1958		1959	
	Short tons	Value	Short tons	Value
Canal Zone:				
Sand and gravel	41,006	$34,616	14,392	$20,500
Stone[2]	140,464	236,848	223,348	270,085
Total Canal Zone	------------	271,000	------------	290,585
Virgin Islands: Stone (basalt)	25,296	80,856	14,429	50,616

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Includes basalt.

REVIEW BY MINERAL COMMODITIES

Sand and Gravel.—Paving sand was mined from local deposits by Panama Sand Co.

Stone (Basalt).—Panama Canal Co. produced crushed and broken basalt for concrete aggregate, roadstone, and riprap.

Miscellaneous stone was quarried and crushed for concrete aggregate and roadstone by the U.S. Army—Caribbean.

TABLE 6.—Sand and gravel sold or used by producers in the Panama Canal Zone

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	39,303	$37,900	1957	------------	------------
1955	35,910	47,229	1958	41,006	$34,616
1956	40,095	48,673	1959	14,392	20,500

TABLE 7.—Crushed basalt and miscellaneous stone sold or used by producers in the Panama Canal Zone

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	110,771	$164,784	1957	59,407	$98,897
1955	169,485	239,280	1958	140,464	236,848
1956	177,250	229,750	1959	223,348	270,085

VIRGIN ISLANDS[8]

Stone output in the Virgin Islands was less than that in 1958. No other minerals were produced.

Basalt.—Basalt was quarried and crushed by the Government of the

TABLE 8.—Crushed basalt sold or used by producers in St. Croix Island, Virgin Islands

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	[1] 5,354	$21,467	1957	11,500	$31,000
1955	875	4,900	1958	25,296	80,856
1956	11,591	31,983	1959	14,429	50,616

[1] Includes miscellaneous stone.

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[8] Prepared by W. G. Diamond and Leovigildo Vazquez.

Virgin Islands, Monserrate Garcia, and Basic Materials, Inc., for concrete aggregate, roadstone, and riprap.

PACIFIC ISLAND POSSESSIONS[9]

REVIEW BY ISLANDS

American Samoa.—Construction and maintenance crews of the Government of American Samoa quarried and processed basalt rock and coral limestone for use as riprap and for building and paving.

Canton.—Crushed coral limestone and sand were used as aggregate and fill material by the Federal Aviation Agency.

Guam.—Crushed coral limestone and beach sand, used for concrete aggregate and fill, were prepared by Government crews and contractors and by commercial producers.

Wake.—Coral limestone was processed by crews and contractors of Government agencies for use in constructing roads, runways, and structural facilities.

Other Pacific Island Possessions.—No mineral production was reported for 1959 on the Islands of Enderbury, Jarvis, Johnston, Midway, and Palmyra.

TABLE 9.—Mineral production in the Pacific Island possessions

Area and mineral	1958		1959	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
American Samoa: Stone (crushed)	30,230	$59,196	177,977	$219,091
Canton:				
Sand			70	63
Stone (crushed)			434	585
Total				648
Guam:				
Sand	8,580	23,100	28,372	19,860
Stone (crushed)	683,548	751,365	567,657	1,109,496
Total		774,465		1,129,356
Midway: Stone (crushed)	175,300	475,840		
Wake: Stone (crushed)	9,560	36,782	31,750	34,152

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[9] Prepared by R. Y. Ashizawa.

The Mineral Industry of Rhode Island

By Joseph Krickich [1]

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VALUE of mineral production in Rhode Island exceeded $2 million for the second consecutive year. The 1959 value of $2.3 million represented a new record and a gain of 4 percent over 1958, the previous high year. The record level of mineral output was due mainly to continuing highway construction and greater demand for stone aggregates.

TABLE 1.—Value of mineral production in Rhode Island, by counties,[1] in thousand dollars

County	1958	1959	Minerals produced in 1959 in order of value
Kent	$951	$1,180	Stone, sand and gravel.
Newport	(2)	17	Do.
Providence	1,058	1,015	Sand and gravel, stone, graphite.
Washington	(2)	121	Sand and gravel, stone.
Undistributed	240	--------	
Total	2,249	2,333	

[1] No production reported from Bristol County.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

REVIEW OF MINERAL COMMODITIES

NONMETALS

Graphite.—Owing to curtailed operations, output of natural amorphous graphite from the State's only underground mine dropped sharply. Production of graphite was suspended in March 1959 following a roof-fall fatality in the mine near Cranston, Providence County. The former metaanthracite mine was idle for the remainder of the year. Graphite was used mainly in preparing foundry facings and as paint pigment.

Sand and Gravel.—Sand and gravel continued to be the leading commodity produced in the State. Production declined 15 percent, due primarily, because of decreased production requirements for paving sand and gravel by Government-and-contractor operations, which dropped from 479,000 tons in 1958 to 124,000 tons in 1959. However, nongovernmental production increased 4 percent during the year.

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[1] Commodity-industry analyst, Bureau of Mines, Region V, Pittsburgh, Pa.

Paving sand and gravel accounted for 45 percent of the State's total output, compared with 69 percent in 1958.

In addition to paving sand and gravel, quantities of building fill, molding fire or furnace and filtration sand, and other sand and gravel as well were produced. Average value per ton of total commercial sand and gravel dropped from $0.97 in 1958 to $0.93 in 1959. In 1959, 70 percent of the State's total output was washed, screened, or otherwise prepared, as compared with 67 percent in 1958.

Total number of reporting commercial producers increased from 19 to 21; one had a portable operation. Employment reported by the State's commercial sand and gravel producers totaled 160 production employees, working 260,000 man-hours; average number of active working days was 233; average length of shift was 8 hours. The State's 21 sand and gravel plants in 1959 produced an average 59.8 tons per man-shift. Less than 1 percent of the commercial production was shipped by rail; the remainder was transported by truck.

Stone.—Miscellaneous stone, limestone, and granite, in decreasing order of value, were quarried. Total stone output increased threefold; value more than doubled, compared with 1958. The sharp increase in stone production was due primarily to the opening of a new quarry in Kent County in June. Crushed stone from the quarry was used exclusively for concrete aggregate and roadstone. Output of limestone, used mainly as agstone, increased slightly. Production of dimension granite used for construction and monumental purposes was reported in Washington County. Output and value of crushed granite fell sharply. Six quarries were active, two each in Providence and Washington Counties, and one each in Kent and Newport Counties. Dimension granite quarried in Massachusetts was processed and fabricated at a yard in Providence County. Employment reported by the State's six producers totaled 57 production employees working 106,000 man-hours. Three nonfatal injuries were reported at one quarry.

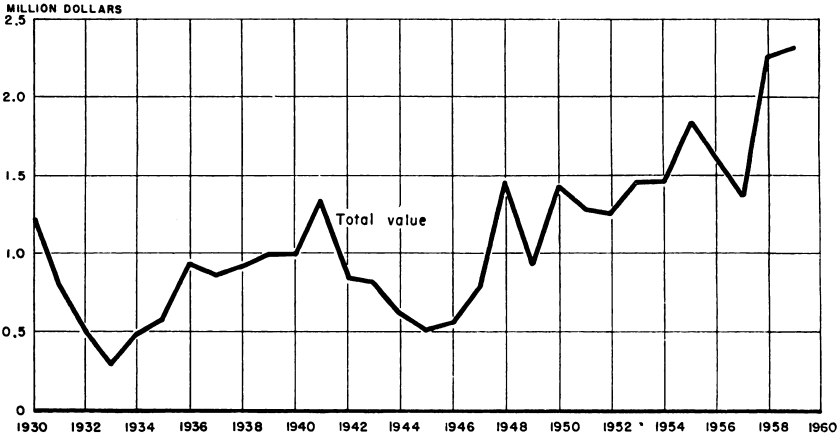

FIGURE 1.—Total value of mineral production in Rhode Island, 1930–59.

METALS

Basic steel was produced at the four open-hearth furnaces of Washburn Wire Co. (Philipsdale). Annual capacity at the steel plant was 93,000 tons of steel ingots. Most raw materials consumed at the plant were shipped from outside the State; they included pig iron, scrap iron and steel, and ferroalloys. Two steel rolling mills at Pawtucket with a combined capacity of 32,000 tons of cold-rolled strip steel were active.

Shipments of ferrous scrap from dealer's yards consisted mainly of Nos. 1 and 2 Heavy-Melting steel, bundles, and cast-iron scrap other than borings. Dealers were active in Providence, Newport, Westerly, and Pawtucket.

Pig iron, pig lead, solder, babbitts, and caulking leads were smelted and refined at a plant near Providence from nonferrous scrap.

Aluminum, brass, bronze, gray iron, malleable, and other castings were produced in numerous foundries throughout the State.

REVIEW BY COUNTIES

Compared with 1958, mineral valuation increases were reported in Kent and Washington Counties; valuation dropped sharply in Newport County, owing to inactivity of the county's leading sand and gravel producer. The increase in Kent County was due mainly to the development of a new stone quarry. Substantial quantities of paving sand and gravel were produced under contract in Kent and Providence Counties for the Division of Roads and Bridges, Department of Public Works, of the State.

Kent.—Kent County dropped to second place as a sand-and-gravel producing area because of decreased output by Government-and-contractor operations. Despite the decreased activity of Government-and-contractor producers, the county produced 42 percent of the State sand and gravel; production dropped from 997,000 tons in 1958 to 725,000 tons in 1959. Of the 1959 output, 10 percent was produced by Government-and-contractor operations. Four commercial producers were active during the year.

Most of the output was used for paving and building purposes. Molding sand was produced at stationary plants by Whitehead Brothers Co. (Washington) and Rhode Island Sand and Gravel Co., Inc. (Warwick). Other producers who operated stationary plants were Luigi Vallone, Inc. (Warwick), and Barbour Sand and Gravel (Coventry). M. A. Gammino Construction Co. quarried and crushed substantial tonnages of miscellaneous stone (schist) at its newly developed quarry near Phenix. Production began in June and was used exclusively for concrete aggregate and roadstone.

Newport.—Among the State's four mineral producing counties, this county ranked last. Mineral valuation dropped sharply, compared with 1958, because the Portsmouth sand and gravel plant of Callan Construction Corp. was not in operation. Limited quantities of conglomerate stone and paving sand and gravel were produced near Middletown by Peckham Bros. Co., Inc. The stone was crushed for use as concrete aggregate and roadstone.

Providence.—Output of sand and gravel by commercial producers in the county increased 13 percent, as compared with 1958. In addition the number of active commercial producers increased from 10 in 1958 to 13 in 1959. Sixty-two percent of the county output was washed, screened, (or otherwise prepared), and used mainly for paving and building purposes. Producers were A. Cardi Construction Co., Inc., and Del Bonis Sand and Gravel, both of Cranston; L. Romano Construction Co., East Providence; Foster Sand and Gravel Co., Inc., Foster; Cormier Sand and Gravel, Inc., Lincoln; Courtois Sand and Gravel Co., Pawtucket; Silvestri Bros. and Joseph Santoro, both of Providence; Tasca Sand and Gravel Co., Smithfield; Town Line Sand and Gravel, Slatersville; Pawtucket Sand and Gravel, Mack Construction Co., and Webster Sand and Gravel. M. A. Gammino Construction Co. (Cranston) discontinued production of sand and gravel because the company started production of crushed stone in Kent County during the year. Conklin Limestone Co., Inc., quarried low-magnesium limestone near Lincoln. The bulk of the output was used as agstone. Limited quantities were sold for blast-furnace flux, fertilizer filler, roofing gravel, and caststone aggregates. Production at the quarry and crusher was not curtailed owing to unfavorable weather conditions as it was the previous year. Crushed and broken granite for riprap, concrete aggregate, and road material was produced near Berkeley by Fanning and Doorley Construction Co., Inc. Providence Granite Co. processed and fabricated building and architectural granite as well as granite for curbing at its yard in Providence. The company used granite quarried in Massachusetts by a subsidiary company. Limited quantities of natural amorphous graphite were recovered and crushed at the Cranston mine of Graphite Mines, Inc.

Washington.—Output of sand and gravel decreased slightly and consisted primarily of prepared material, used mainly for paving and building purposes and as fill material. Producers were South County Sand and Gravel Co., Louis B. Schaeffer, and J. Romanella and Sons. Dimension granite for rough construction work and monumental purposes was quarried near Bradford by Westerly Granite Corp. Dressed granite for construction work was produced by Oscar Larson at Hopkinton.

The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement for collecting mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the South Carolina Geological Survey.

By Lawrence E. Shirley[1] and Laurence L. Smith[2]

❖

RECORD production of cement, crushed stone, clays, sand and gravel, and vermiculite highlighted the mineral industry of South Carolina in 1959. Total mineral output in the State attained a new high for the fifth consecutive year, with an increase in value of more than $8 million over 1958.

South Carolina ranked second in the Nation in output of kaolin, kyanite, and vermiculite, and was fourth in mica. The principal industries were manufacturing cement, crushing stone, processing clays, and mining sand and gravel. Leading companies were Carolina Giant Division of Giant Portland Cement Co. (portland and masonry cement, clays, and marl), Campbell Limestone Co. (crushed granite and limestone), J. M. Huber Corp. (kaolin), and Becker County Sand & Gravel Co. (sand and gravel).

TABLE 1.—Mineral production in South Carolina[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Clays	929	$5,157	1,160	$5,920
Gem stones	(2)	(3)	(2)	(3)
Mica (sheet) pounds	1,144	8	251	3
Peat short tons	4,865	(4)	4,194	(4)
Sand and gravel	2,946	2,858	3,105	3,077
Stone[5]	3,637	5,229	6,247	8,647
Zirconium concentrate short tons	141	5	----------	----------
Value of items that cannot be disclosed: Barite, cement, kyanite, scrap mica, rare-earth metal concentrates (1958), staurolite (1958), stone (limestone, marl, and sandstone (1959), titanium (1958), vermiculite, and values indicated by footnote 4	----------	9,586	----------	13,640
Total, South Carolina[6]	----------	22,412	----------	30,598

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Excludes limestone, marl, and sandstone (1959); included with value of items that cannot be disclosed.
[6] Total adjusted to eliminate duplicating value of clays and stone.

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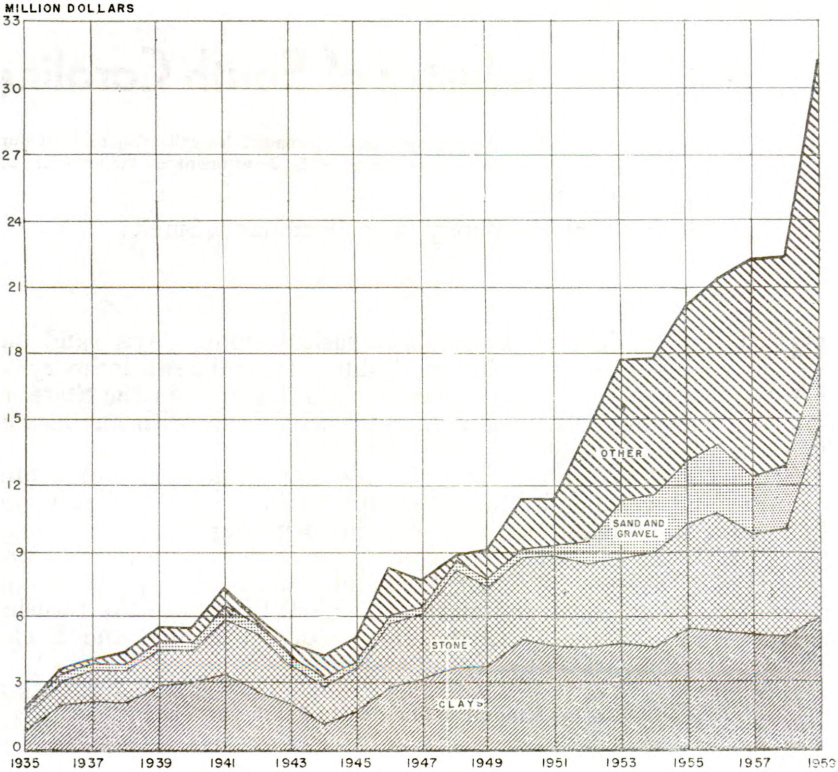

FIGURE 1.—Value of clays, stone, sand and gravel, and total value of minerals produced in South Carolina, 1935–59.

Employment and Injuries.—Reports submitted to the Bureau of Mines by producers in the mineral industries indicated that 36 percent more mines, mills, and quarries were active during the year, and that employment increased 26 percent. A large increase in employment in nonmetal mines was recorded because two new brick plants reported for the first year. Average active days worked increased 5 percent and total man-hours worked in all mines, quarries, and mills increased 31 percent.

The overall frequency rate for injuries per million man-hours increased 32 percent. Nonfatal injuries increased 76 percent; injuries in nonmetal mines, quarries, and mills more than doubled, but injuries in sand and gravel mines decreased. Two fatal accidents occurred during the year, compared with one in 1958.

Trends and Developments.—A greatly enlarged Federal-aid highway-construction program, led by the Interstate Highway System construction program, was responsible for increased use of mineral materials in road and bridge construction. This trend was expected to continue for the next decade or until completion of the proposed roadbuilding program. South Carolina led the Southeastern States in the number of Interstate highway miles under construction and

TABLE 2.—Employment and injuries in the mineral industries

Industry	Active operations	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
	1958						
Nonmetal mines	34	841	242	1,698,657	1	31	19
Quarries and mills	15	659	255	1,344,931	----------	22	16
Sand and gravel mines	27	276	240	529,665	----------	13	24
Total	76	1,776	246	3,573,253	1	66	19
	1959[1]						
Nonmetal mines	41	1,173	252	2,370,039	1	63	27
Quarries and mills	21	812	267	1,733,090	1	44	26
Sand and gravel mines	41	278	260	579,541	----------	9	15
Total	103	2,263	258	4,682,670	2	116	25

[1] Preliminary figures.

was second only to Texas in the Nation. During the year, five Interstate projects were completed in Laurens, Newberry, and Cherokee Counties. Physical-research studies were conducted by the Federal Bureau of Public Roads, in cooperation with the State highway department, on load-deflection of selected flexible pavements. The 679 miles of Interstate highways in South Carolina was estimated to cost $340 million; 90 percent of the cost was to be paid by the Federal Government and 10 percent by the State.

South Carolina electric power companies were undergoing a shift in emphasis from agriculture to industrial development, a trend much evident throughout the State. This shift called for additional generating facilities and increased use of coal, gas, and oil as fuel. The McMeekin plant of the South Carolina Electric & Gas Co. was judged the most efficient steam plant in the Nation; the plant consumed 420,000 tons of bituminous coal during the year. The State had six companies operating eight plants with an installed capacity of over 1 million kilowatt hours; fuel consumption was 60 percent coal, 38 percent gas, and 2 percent oil during the year. Three new plants were programmed for completion by 1962.

During the year progress was made in port expansion and development to handle the ever-increasing volume of exports and imports channeled through South Carolina ports. In Georgetown the $1.5 million dock and transit shed was completed and put into use; a $3 million segment of the Charleston pier was finished; and work began on Union pier and its extension; new chemical and oil-storage facilities were built or planned.

Carolina Giant Division of Giant Portland Cement Co., Harleyville, planned to increase plant capacity from 2.9 to 4.0 million barrels per year; a new brick and tile plant was being built by Eastern Brick & Tile Co. at Sumter; Southern Brick Co. installed new facilities, raising daily production to 150,000 bricks; and Owens-Corning Fiberglas Corp. announced that a new fiber-glass plant would be built at Aiken.

Legislation and Government Programs.—A U.S. Tax Court decision involving percentage depletion allowance was handed down, which affected two South Carolina mineral-producing companies, Winnsboro Granite Corp. and Rion Crushed Stone Co., Fairfield County.[3] Winnsboro Granite Corp. extracted monumental stone from its quarry and transported it, mostly by rail, to a town 15 miles away, which was its f.o.b. point for interstate shipments. Rion Crushed Stone Corp. quarried, crushed and sold its stone largely for highway construction and paving. Because of highway-department requirements, nearly all bids were made f.o.b. destination. The court agreed with the Government that transportation costs were not properly part of the gross income from the property, since transportation was not necessary for further processing. Costs could not be claimed for hauling to the f.o.b. pricing point if no allowable processing took place at destination.

The U.S. Atomic Energy Commission (AEC) granted a 4-year extension of contract to E. I. du Pont de Nemours & Co. for operating the Savannah River plant. The contract, which would cost about $100 million a year, was for operation of five production reactors, two chemical separation areas, and a plant for production of heavy water (D_2O). The facility produced about 450 tons of D_2O for use in its own reactors, for research, and for sale. Facilities at Savannah River were designed primarily for processing natural uranium fuels from production reactors and not for enriched fuels. To make 1 pound of heavy water required 40,000 pounds of feed water, 6,000 pounds of steam, and 1,500 gallons of cooling water.

In connection with its waste-disposal program AEC contracted with a local company to construct and install four 1.3-million-gallon tanks for radioactive waste storage. Each tank was to be constructed of steel, encased in concrete, and buried underground.

A South Carolina legislative committee held public hearings during the year on air pollution, a subject of much controversy in certain heavily industrialized areas. The purpose of these hearings was to provide the State with an air-pollution law.

The State highway department entered into an agreement with the U.S. Army Engineers for relocating and rebuilding certain roads affected by the Hartwell Dam Project on the Savannah River. The relocation would cost more than $4 million, and the Federal government agreed to give the money to the State highway department.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—Industrial Minerals, Inc., Cherokee County, the only barite producer in South Carolina, increased output 43 percent in quantity and more than 100 percent in value over 1958. The crude barite was ground for use by the rubber industry and then shipped out of State.

Cement.—Records were established for output of masonry and portland cement; increases had been made each year since production of portland cement began in 1949 and masonry in 1957. Both were produced by Carolina Giant Division of Giant Portland Cement Co. Masonry output increased 52 percent and value 4 percent; portland cement increased 40 percent in output and 45 percent in value, compared with the 1958 record. For the year ahead the company announced plans to install a fourth kiln with an annual capacity of 1,100,000 barrels and additional storage and shipping facilities. This will be the third expansion of the plant since it was built in 1948. The demand for cement in South Carolina and surrounding States was high because of increased roadbuilding and construction. Most of the out-of-State shipments were by rail.

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[3] Rock Products, vol. 62, No. 10, 1959, pp. 60, 64.

Clays.—New records were set for kaolin and miscellaneous clay. Kaolin output increased 18 percent in tonnage and 13 percent in value over the previous record year, 1958; miscellaneous clay output and value increased 30 and 28 percent, respectively, over 1958, also a record year. Kaolin was produced at 14 mines in Aiken and Richland Counties; and miscellaneous clay, used for cement and heavy clay products, at 11 mines in Dorchester, Fairfield, Greenwood, Lancaster, Lexington, Marlboro, Marion and Richland Counties. One new mine each for kaolin and miscellaneous clay reported production for 1959. South Carolina ranked second in the Nation in production of kaolin. The three leading kaolin producers were J. M. Huber Corp., Dixie Clay Co. and National Kaolin Products Co. The three leading producers of miscellaneous clay were Carolina Giant Division of Giant Portland Cement Co., Dorchester County, Columbia Brick & Tile Co., Richland County, and Southern Brick Co., Greenwood County.

A new brick and tile plant was being built by Eastern Brick & Tile Co. at Sumter. The plant will employ about 40 people and start operations in early 1960. The company will use natural gas for kiln heating and get its brick clay from a 93-acre site near the plant. The Southern Brick Co. of Ninety Six installed a second 325 foot Harrop kiln with a twin-tunnel gas-fired dryer as part of an expansion program, and added a Steele vacuum-pug combination-brick machine, raising daily production at the tunnel-kiln plant to 150,000 bricks.

TABLE 3.—Kaolin sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Rubber	202,373	$2,704,814	$13.37	229,442	$2,829,645	$12.33
Insecticides and fungicides	25,938	341,409	13.16	49,464	579,081	11.71
Saggers, pins, stilts and wads	(1)	(1)	(1)	4,400	59,532	13.53
Plaster and plaster products	1,200	16,344	13.62	2,000	27,060	13.53
Whiteware	12,863	169,074	13.14	(1)	(1)	(1)
Exports	3,798	49,374	13.00	(1)	(1)	(1)
Chemicals	1,600	21,792	13.62	(1)	(1)	(1)
Floor and wall tile	150	1,950	13.00	--------	--------	--------
Other uses[2]	129,613	1,359,606	10.49	160,780	1,796,779	11.18
Total	377,535	4,664,363	12.35	446,086	5,292,097	11.86

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."

[2] Includes whiteware, art pottery, firebrick and block, other refractories, paper filler, paper coating, linoleum and oilcloth, paint, fertilizer, other fillers, chemicals, exports, and other uses.

Studies[4] were conducted during the year on the geology and mineral resources of clays pertaining to the following: Brick clays in Berkeley County, silicious clays (fuller's earth) of the South Carolina coastal plain, brick clays of the Blaney and Fort Jackson north quadrangles, and kaolin and brick clays in Sumter County. Several short investigations were made of kaolin deposits in Lexington, Richland, and Kershaw Counties. The investigators concluded that extensive deposits occur in these areas suitable for manufacturing brick, and, with beneficiation, for higher specifications. During the year the Bureau of Mines metallurgy-research laboratory at Norris, Tenn., completed several tests and analyses on refractory and common clays from South Carolina.

Feldspar.—Feldspar was produced for the first year by Paco Products, Inc., from granite screenings mined by Campbell Limestone Co. at its Pacolet quarry. The material was shipped out of State for use by the glass industry.

Gem Stones.—Sillimanite crystals from Oconee County, tourmaline crystals from Spartanburg County, and miscellaneous minerals from Lexington County were collected and sold to collectors or tourists as souvenirs.

Kyanite.—South Carolina ranked below Virginia, the only other kyanite-producing State. The quantity and value of production increased 18 and 71 percent, respectively, over 1958. Commercialores, Inc., Henry Knob mine, York County, the only producer, shipped the material out of State to producers of refractories.

During the year a preliminary investigation by the State Development Board[5] indicated several million tons of kyanite-bearing quartzite on Little Mountain, Newberry County.

Norris metallurgical laboratory, tested kyanite samples from the State during the year to determine their suitability for refractories.

Mica.—Sheet mica was produced in three counties and scrap mica in one county. The State ranked fourth in the Nation in the production of scrap mica. Production of full-trimmed sheet mica, all from pegmatite deposits, came from eight operations in Anderson, Cherokee, and Spartanburg Counties. Output declined drastically in quantity and value from 1958. Full-trim sheet mica was sold to the GSA Materials Purchasing Depot, Spruce Pine, N.C., at an average price of $11.23 per pound. Mineral Mining Corp. recovered scrap mica from an opencut mica schist deposit in Lancaster County; output increased 21 percent and value 47 percent over 1958. The corporation also produced dry-ground mica, used principally in manufacturing paint, pipeline enamel, plastics, and welding rods. Much of the material was shipped out of State.

Phosphate Rock.—The presence of phosphate rock in South Carolina has been known for over 100 years; the first phosphate rock produced in the United States came from the State. Over 13 million tons of land-rock and river-rock phosphate valued at over $58 million were mined from 1867 to 1938. In the Charleston phosphate area, which embraces Charleston County and parts of Dorchester and Berkeley Counties, reserves of phosphate rock were estimated to be between 8 and 9 million tons.[6]

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[4] Johnson, H. S., Jr., Geologic Activities in South Carolina in 1959: Geologic Notes, Division of Geology, State Development Board, vol. 4, No. 1, January–February 1960, pp. 1–7.

[5] Work cited in footnote 4.

Beaufort Mining & Development Co., Beaufort County, announced during the year that tidewater phosphate-rock mining would begin in the Coosaw River area of the county, near the Port Royal ocean terminal.

Sand and Gravel.—South Carolina produced more sand and gravel in 1959 than in any previous year, meeting demands by the Federal Interstate Highway System and other construction programs throughout the State. Production was expected to remain high until the proposed road and construction programs are completed, about 11 years. Sand and gravel production increased 5 percent in output and 8 percent in value over 1958. Sand and gravel was produced at 41 mines (by 27 companies) in 22 counties throughout the State. All were commercial operations except that of the South Carolina State Highway Department. The highway department produced paving sand at 13 mines in 13 counties (45,309 tons of sand valued at $21,080), with an increase of 11,014 tons over 1958. Two companies produced structural and fill gravel and railroad ballast gravel. Shipments of sand and gravel were 49 percent by railroad, 42 percent by truck, and 9 percent by waterway. Leading producers of sand and gravel were Becker County Sand and Gravel Co. in Marlboro and Sumter Counties, and Columbia Silica and Sand Co. and Capitol Sand Co., in Lexington County. Owens-Corning Fiberglas Corp. announced that a new fiber-glass yarn plant at Aiken County, would be built; initial production was scheduled for June 1960. The company also had a plant near Anderson.

TABLE 4.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Anderson	3,099	$1,147	800	$360
Chester	4,185	1,674	4,845	1,938
Dorchester	22,584	16,623	26,835	19,153
Florence	----------	----------	(1)	(1)
Greenville	48,922	27,543	89,599	39,502
Horry	245,430	212,700	(1)	(1)
Kershaw	(1)	(1)	52,355	107,043
Lancaster	----------	----------	2,700	675
Lexington	472,973	229,582	590,786	282,018
Marion	(1)	(1)	14,093	14,093
Oconee	6,294	2,329	5,352	2,408
Richland	(1)	(1)	152,978	57,387
Spartanburg	12,159	11,855	2,007	903
Union	----------	----------	400	200
York	1,775	657	910	410
Undistributed[2]	2,128,890	2,354,042	2,160,854	2,550,832
Total	2,946,311	2,858,152	3,104,514	3,076,922

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes production from the following counties: Aiken, Charleston, Cherokee, Chesterfield, Jasper, Marlboro, and Sumter, also values indicated by footnote 1.

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[6] Malde, H. E., Geology of the Charleston Phosphate Area, S.C.: Geol. Survey Bull. 1079, 1959, 105 pp.

TABLE 5.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Structural sand	1, 137, 136	$592, 628	$0. 52	1, 179, 287	$621, 283	$0. 53
Paving sand	425, 781	189, 941	. 45	449, 519	154, 965	. 34
Engine sand	22, 233	21, 596	. 97	23, 040	43, 858	1. 90
Other sand and gravel [1]	1, 361, 161	2, 053, 987	1. 51	1, 452, 668	2, 256, 816	1. 55
Total	2, 946, 311	2, 858, 152	. 97	3, 104, 514	3, 076, 922	. 99

[1] Includes glass, molding, blast, furnace, filter, and other sands, and structural, railroad-ballast and fill gravel.

Staurolite.—No production of staurolite was reported for 1959. Staurolite had been recovered as a byproduct of heavy-mineral mining operations, which closed at the end of 1958.

Stone.—A record high was set for stone production in 1959. Total output increased 73 percent in quantity and 69 percent in value, primarily due to increased road building and cement production. Crushed granite increased 72 percent in tonnage and 69 percent in value, setting a new record over 1958; crushed limestone output increased 110 percent in tonnage and 107 percent in value; dimension granite increased 17 percent in tonnage and 10 percent in value; calcareous marl increased 51 percent in quantity and 61 percent in value. All of the dimension granite was used for monumental stone. Crushed quartz, production of which was reported for the first year, was used for abrasives and in the manufacture of enamel and glass. The material was recovered from granite screenings at the Campbell Limestone Company Pacolet quarry.

Crushed granite was produced from 11 mines, in 8 counties, by 6 companies; dimension granite in 2 counties by 3 companies; crushed limestone and marl in 2 counties by 2 companies; and crushed quartz in 1 county by 1 company. Largest producers of crushed granite were Campbell Limestone Co., Spartanburg and Pickens Counties; Palmetto Quarries, Richland County; and Weston & Brooker, Lexington County. Production of crushed granite from Newberry County was reported for the first year. Dimension granite, sold as rough monumental stone, was produced by Comolli Granite Co. and Winnsboro Granite Co., Fairfield County, and Kershaw Granite Co., Kershaw County. Campbell Limestone Co., Cherokee County, and Volunteer Portland Cement Co., Dorchester County, were the only producers of crushed limestone. Carolina Giant Division of Carolina Giant Cement Co., Dorchester County, produced marl for use in manufacturing cement. The new crushed granite quarry of Clement Bros., at Pomaria, Newberry County, was described.[7] The quarry was typical of several new operations throughout the State engaged in supplying crushed stone as base materials for the Federal Interstate Highway program.

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[7] Meschter, Elwood, Blue Granite Challenges Road Builder: Rock Products, vol. 62, No. 8, August 1959, pp. 114–118.

Investigations of stone by the State Development Board during the year were of: The mineral resources of Orangeburg County, where a large reserve of limestone averaging 80 to 95 percent calcium carbonate was outlined; promising limestone and marl deposits in Calhoun, Dorchester, and Berkeley Counties; the Calhoun Falls gabbro, Abbeville County, as a potential source of crushed stone, polished stone panels, and possibly roofing granules; and granite occurrences in Newberry County, suitable for monumental and construction purposes.

TABLE 6.—Crushed granite sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roadstone	2,922,265	$4,229,973	$1.45	5,346,058	$7,555,243	$1.41
Railroad ballast	421,167	482,999	1.15	(1)	(1)	(1)
Other [2]	281,357	171,869	.61	886,871	714,632	.81
Total	3,624,789	4,884,841	1.35	6,232,929	8,269,875	1.33

[1] Figure withheld to avoid disclosing individual company confidential data, included with "Other."
[2] Includes railroad ballast, stone sand, riprap, and other uses.

Vermiculite.—Crude vermiculite output reached a new high in 1959. Three companies produced crude ore from numerous mines in three adjoining counties. Zonolite Company, Laurens County, continued to be the principal producer, mining crude ore in Laurens, Spartanburg, and Union Counties, and processing the ore at its Kearney plant in the Enoree area. Zonolite shipped the processed ore to its own exfoliating plant near Travelers Rest, Spartanburg County, and to out-of-State exfoliating plants. Patterson Vermiculite Co. mined crude ore in the Enoree area adjacent to its own exfoliating plant. American Vermiculite Co., Roan Mountain, Tenn., mined crude ore in Laurens and Spartanburg Counties and operated an exfoliating plant in the Enoree area, Laurens County. Most of the material was marketed for use in loose-fill insulation, lightweight aggregate, plaster, concrete, fertilizer, and floral needs. The State ranked second in the Nation in crude ore production.

METALS

Ferroalloys.—Pittsburgh Metallurgical Co., Inc., Charleston County, operated an electric-arc-furnace plant near Charleston, employing 225 people. The company produced ferromanganese, silicomanganese, ferrosilicon, and ferrochromium.

Gold.—The Landrum Gold mine, Edgefield County, was described, and the results of sampling were published[8] by the State Development Board. The mine, inactive since 1935, was worked as early as 1856, but early history and production figures are largely unknown. Assays indicated that the average value of the rock, where mineralized, is $5–$6 per ton, based on the 1959 gold price.

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[8] Smith, L. L., The Landrum mine, Edgefield County, South Carolina: State Development Board, Geologic Notes, vol. 3, No. 3, 1959, pp. 1–10.

Rare-Earth-Metal Concentrates.—South Carolina, which led the States in the production of rare-earth-metal concentrates in 1958, did not produce in 1959. Heavy Minerals Co., Aiken County, the sole producer, ceased operations in March 1958.

Titanium Concentrates.—Rutile production from the Horse Creek property, previously reported by Heavy Minerals Co. ceased after company operations ceased in 1958.

Zirconium.—Orefraction Minerals, Inc., Andrews, Georgetown County, continued to operate its grinding plant, using zircon ore from Florida; the ground ore was marketed as zircon flour and ceramic zircon and was shipped out of State. State production of zircon ore was halted when the sole producer, Heavy Minerals Co., ceased operations.

MINERAL FUELS

Peat.—Humus peat, for use as a soil conditioner, was produced in Colleton County; output decreased 14 percent.

Petroleum.—In October the State leased its marshlands and offshore waters for 3 years to two individuals, who planned to make seismic investigations and to drill one or more wells during the initial 3-year period. The coastal area of South Carolina was believed to have an appreciable potential for oil, particularly beneath the wide Continental Shelf. Coastal waters off Charleston and Beaufort are less than 100 feet deep for a distance of 35 miles, thus providing a large area accessible to modern exploration methods.

REVIEW BY COUNTIES

Mineral production was recorded in 28 of the 46 counties in the State, one more county than in 1958. Dorchester and Aiken Counties, for the fourth consecutive year, furnished more than 50 percent of the total mineral-production value. The leading 10 counties (Dorchester, Aiken, Spartanburg, Fairfield, Lexington, Richland, Laurens, Cherokee, Marlboro, and Pickens) furnished 86 percent of the total mineral-production value. All 10 of these counties had over $1 million in production value, an appreciable increase over the number of counties having this value in 1958.

Aiken.—Aiken County, for the fourth consecutive year, was the second most important county in the State in value of mineral production. Eleven mines operated by seven companies produced a total of 410,000 tons of kaolin valued at $5,118,000—an increase of 19 percent in quantity and 12 percent in value over 1958. Aiken was the largest kaolin-producing county in the State, and the three largest producers were in the county. They were J. M. Huber Corp. (Barden and Paragon mines), Dixie Clay Co. (McNamee mine), and National Kaolin Products Corp. (Aiken mine). Other active operations in the county were Bell Kaolin Co. (Batesburg mine), International Clay Co. (Graniteville mine), and Southeastern Clay Co. (Gardner, Johnson, Rodgers, and Toole mines). There was no production of rutile, zircon, monazite or staurolite during the year. Perry Minerals Co., Inc. (Marine Minerals mine), produced sand and gravel, and the South Carolina State Highway Department mined paving sand for its own use, but at a volume below 1958.

TABLE 7.—Value of mineral production in South Carolina, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Abbeville	$177	----------	
Aiken	(2)	(2)	Kaolin, sand and gravel.
Anderson	4,069	$1,648	Mica, sand and gravel.
Charleston	(2)	(2)	Sand and gravel.
Cherokee	(2)	(2)	Limestone, sand and gravel, barite, mica.
Chester	1,674	1,938	Sand and gravel.
Chesterfield	(2)	(2)	Do.
Colleton	(2)	(2)	Peat.
Dorchester	(2)	(2)	Cement, marl, miscellaneous clay, limestone, sand and gravel.
Fairfield	(2)	(2)	Granite, miscellaneous clay.
Florence	(2)	(2)	Sand and gravel.
Greenville	660,647	(2)	Granite, sand and gravel.
Greenwood	86,130	(2)	Granite, miscellaneous clay.
Horry	212,700	(2)	Sand and gravel.
Jasper	(2)	(2)	Do.
Kershaw	(2)	164,642	Sand and gravel, granite.
Lancaster	(2)	(2)	Mica, miscellaneous clay, sand and gravel.
Laurens	(2)	(2)	Vermiculite.
Lexington	(2)	(2)	Granite, sand and gravel, miscellaneous clay, gem stones.
Marion	(2)	(2)	Sand and gravel, miscellaneous clay.
Marlboro	(2)	(2)	Do.
Newberry	----------	875,000	Granite.
Oconee	(2)	2,708	Sand and gravel, gem stones.
Pickens	(2)	(2)	Granite.
Richland	(2)	(2)	Granite, kaolin, miscellaneous clay, sand and gravel.
Spartanburg	(2)	(2)	Granite, quartz, feldspar, vermiculite, mica, sand and gravel, gem stones.
Sumter	(2)	(2)	Sand and gravel.
Union	----------	(2)	Sand and gravel, vermiculite.
York	(2)	(2)	Kyanite, sand and gravel.
Undistributed	21,446,503	29,553,776	
Total	22,412,000	30,598,000	

[1] The following counties are not listed because no production was reported: Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Clarendon, Darlington, Dillon, Edgefield, Georgetown, Hampton, Lee, McCormick, Orangeburg, Saluda, and Williamsburg.

[2] Figure withheld to avoid disclosing individual company confidential data, included with "Undistributed."

Anderson.—Joe L. Snyder (Emma Mine), Henry Grindstaff (Gillard mine), Frank Holland (Holland mine), and Ben B. Williams (Williams mine) sold sheet mica from pegmatite deposits. The State highway department mined paving sand for its own use; tonnage and value decreased considerably from 1958.

Charleston.—Edisto Sand and Gravel Co. (Edisto mine) and Sandrying Co. (North Charleston mine) produced construction sand and sand for fertilizer filler.

Cherokee.—Cherokee County ranked eighth in the State in value of mineral production. Industrial Minerals, Inc. (Kings Creek mine), mined barite, and production increased considerably over 1958. Campbell Limestone Co. (Blacksburg quarry) crushed limestone for concrete aggregate, roadstone, and agricultural use; tonnage and value more than doubled over 1958. Dick Shehan (Oglesby mine) produced a small quantity of sheet mica from a pegmatite deposit. Jobe Sand Co. (Blacksburg mine) and the State highway department mined engine and paving sand.

Chester.—Paving sand was mined by the State highway department for use in the highway program. Production increased over 1958.

Chesterfield.—Becker County Sand & Gravel Co. (Cash mine) increased production considerably during the year, making the county an important producer of sand and gravel; output of both sand and gravel more than trebled over 1958. The State highway department mined paving sand for use in its road program. Tonnage and value increased over 1958.

Colleton.—Ti-Ti Humus Co., Inc., Green Pond, produced 4,200 tons of peat, a decrease of 14 percent from 1958. The material, classified as humus peat, was sold in bulk and packages for use as a soil conditioner.

Dorchester.—Dorchester County, for the fourth consecutive year, led in value of mineral production with an increase of 14 percent over 1958, the previous record year. The tonnage mined also established a new high. Carolina Giant Division of Carolina Giant Cement Co., the leading producer of miscellaneous clay and marl in the State, mined both at a higher rate than in any previous year. Masonry and portland cement production by the company also reached a record high; masonry cement output increased 52 percent in quantity and 4 percent in value; portland cement increased 40 percent in quantity and 45 percent in value over the 1958 record. The company announced plans for the third expansion of its plant since it was built in 1948, construction of a fourth kiln with an annual capacity of 1,100,000 barrels, and additional storage and shipping facilities. Volunteer Portland Cement Co., Agstone Division, mined agricultural limestone and increased output over 1958. Salisbury Brick Corp. (Salisbury mine) increased miscellaneous clay output 50 percent in quantity and 49 percent in value over 1958. Murray Sand Co. (Murray mine) and Hayes Sand Co. (Hayes mine) produced building sand for local consumption.

Fairfield.—Fairfield County ranked fourth in the State in value of mineral production. Rion Crushed Stone Corp. (Rion quarry) and Palmetto Quarries Co. (Blair quarry) crushed granite for concrete aggregate, roadstone, and screenings; Palmetto Quarries Co. increased output 80 percent in tonnage and 64 percent in value over 1958. Comolli Granite Co. (Carolina Mahogany quarry) and Winnsboro Granite Co. (Winnsboro quarry) produced dimension granite for the monument industry; output changed only slightly from 1958. Richland Shale Products Co. (Richtex mine) mined miscellaneous clay and shale for use in its brick and tile plant.

Florence.—Coastal Sand Co. (Johnsonville mine) produced building and paving sand; output decreased 40 percent from 1958. Lanford Sand Co. (Florence mine) reported production of building sand for the first year.

Greenville.—Campbell Limestone Co. (Lakeside quarry) crushed granite for use in road construction and other purposes; output increased 34 percent in quantity and 35 percent in value over 1958. W. M. Barber Sand Co., Saluda Sand Co. (Garrison mine), and Zupan Sand Co. (Greenville mine) produced building sand. The State highway department produced paving sand for its own use.

Greenwood.—Angus Brick & Tile Co. (Ninety Six mine) and Southern Brick Co. (Ninety Six mine) produced miscellaneous clay and shale for manufacturing brick; combined production increased slightly over 1958. Southern Brick Co. was the third largest producer of miscellaneous clay and shale in the State. In an expansion program completed during the year the company installed a second 325-foot Harrop kiln with a twin-tunnel gas-fired dryer, and a Steele vacuum-pug combination-brick machine, raising daily production at the tunnel kiln plant to 150,000 bricks per day. Palmetto Quarries Co. (Greenwood quarry) reported satisfactory production of crushed granite the first year; it was used for concrete, roadstone, and railroad ballast.

Horry.—J. F. Cleckley & Co. (Conway mine) produced paving sand; output decreased 50 percent below 1958. Locher Silica Corp. (Pitts mine) produced glass sand; production increased 20 percent in tonnage and 28 percent in value over 1958. The Dobbs Co. (Dobbs mine) produced building sand for a few months and then went out of business; therefore, output was much less than in 1958.

Jasper.—Deerfield Sand & Mining Co., Inc. (Deerfield mine), mined building and paving sand; tonnage and value decreased 17 and 14 percent, respectively, below 1958.

Kershaw.—Kershaw Granite Co., Inc. (Kershaw quarry), quarried dimension granite for the monumental stone industry; production and value more than doubled that of 1958. Whitehead Bros. Co. (Lugoff mine), whose operation was begun in 1958, mined molding sand; tonnage and value increased considerably over 1958. Kershaw County Sand Co. (Camden mine) produced 24,800 tons of masonry sand valued at $12,400, and total production decreased slightly below 1958. The State highway department produced paving sand for its own use.

Lancaster.—Mineral Mining Corp. (Kershaw Strip mine) produced scrap mica from a mica schist deposit; the material was dry-ground and used in paint, plastic, enamel, and welding rods. This was the only operation of its kind in the State; other scrap mica was mined from pegmatite deposits. Ashe Brick Co. (Van Wyck mine) mined miscellaneous clay for brick manufacture; 68,700 tons valved at $61,200 was produced, an increase of 13 percent in tonnage and 3 percent in value over 1958. The State highway department produced paving sand and reported production for the first year.

Laurens.—Laurens County ranked seventh in the State in value of mineral production. Vermiculite, the only mineral produced, showed a sizable increase in quantity and value over 1958. South Carolina ranked second in the Nation in vermiculite production for the year. Zonolite Co. (Enoree area mines) mined and processed crude ore at its Kearney plant near Enoree. The ore was shipped to the Zonolite Co. exfoliating plant in an adjoining county and to out-of-State exfoliating plants. Patterson Vermiculite Co. mined crude ore in the Enoree area adjacent to its own exfoliating plant; this was the first year that this mine and plant reported production. American Vermiculite Co., of Roan Mountain, Tenn., mined crude ore and operated an exfoliating plant in the Enoree area. Most of the material from this area was marketed for loose-fill insulation, plaster, concrete, fertilizer, lightweight aggregate, and use by florists.

Lexington.—Lexington County ranked second in the State in sand and gravel production and fifth in total value of mineral production.

Weston & Brooker Quarry Co. was the fifth ranking stone producer in the State; the company also crushed granite for concrete, roadstone, screenings, and railroad ballast. Tonnage and value increased 23 and 34 percent, respectively, over 1958. Guignard Brick Co. (Columbia mine) produced miscellaneous clay for use in its brick plant; tonnage increased but the value declined slightly. Columbia Silica Sand Co. (Edmund mine), the third largest producer of sand and gravel in the State, mined industrial sand for blasting, furnace, engine and filtration, fertilizer filler, and building and paving sand; tonnage and value increased 36 percent over 1958. Capitol Sand Co. (Capitol mine), the fourth largest producer of sand and gravel in the State, mined paving sand; output increased 20 percent in tonnage and 32 percent in value over 1958. Foster Bros. Dixiana Sand Co. (Dixiana mine) mined industrial sand for blasting, engine, filtration, and fertilizer filler; tonnage increased 11 percent and value decreased 6 percent from 1958. Southeastern Sand Co. (Cayce mine) mined building sand at almost the same rate as in 1958. The State highway department mined paving sand for its own use. Frank L. Sims produced miscellaneous gem minerals for sale to collectors and tourists.

Marion.—J. D. Murchison (Pee Dee mine) mined miscellaneous clay and shale for manufacturing brick; tonnage increased 11 percent and value increased slightly over 1958. Sandy Bluff Sand Co. (Snipes mine) mined 14,100 tons of sand valued at $14,000; quantity and value more than doubled over 1958.

Marlboro.—Marlboro County ranked first in the State in the production of sand and gravel and ninth in value of mineral production. Becker County Sand & Gravel Co. (Marlboro mine), the leading producer of sand and gravel in the State, mined building sand and construction gravel for building, chemical or metallurgical uses, and railroad ballast; sand output increased 11 percent and gravel output 7 percent over 1958. Palmetto Brick Co. (Irby mine) produced miscellaneous clay and shale for brick manufacture; tonnage increased 26 percent and value 56 percent over 1958. Cheraw Brick Works (Cheraw mine) produced miscellaneous clay and shale for use in its own brick plant. Lawrence Stone & Gravel Co. (Blenheim mine) mined 50,000 tons of building sand valued at $25,000; tonnage and value more than trebled that of 1958.

Newberry.—Clement Bros., of Hickory, N.C. (Pomaria quarry), crushed granite for use in the Interstate Highway construction program. The quarry produced 700,000 tons valued at $875,000 and reported production for the first year.

Oconee.—The State highway department produced 5,350 tons of paving sand valued at $2,410 for use in its road program. Bob Daniel, Franklin, N.C., produced 3 pounds of sillimanite crystals valued at $300 for sale to collectors and tourists.

Pickens.—Campbell Limestone Co. (Beverly quarry), the only mineral producer in the county, crushed granite for use as riprap, in concrete, as roadstone, and for railroad ballast. The material was transported mainly by truck and in lesser amount by rail.

Richland.—Richland County ranked sixth in the State in value of mineral production and was exceeded only by Aiken County in the production of kaolin. Refractory clay was mined by Carolina Ceramics, Inc. (Pontiac mine), Columbia Pipe Co. (Ridgewood mine), and R. M. Stork Fire Brick Works (Stork mine); total production for the listed mines increased 8 percent and value, more than 100 percent over 1958. Columbia Brick & Tile Co. reported production of miscellaneous clay from the Columbia mine for the first year; output, 90,000 tons valued at $80,100, was used in manufacturing brick and tile. Palmetto Quarries Co. (Columbia quarry), the third largest crushed-granite producer in the State, crushed granite for concrete, roadstone, railroad ballast, and stone sand; production increased 25 percent in tonnage and 21 percent in value over 1958. Harrison Sand Corp. (Harrison mine) mined 93,000 tons of building and industrial sand valued at $36,000; the increase was 63,000 tons more than in 1958. Strickland Sand Co. (Columbia mine) mined building and paving sand for local uses. Output was 13 percent more than in 1958.

Spartanburg.—Spartanburg County was the third leading county in the State in value of mineral production and ranked first in the State in output of crushed granite. Campbell Limestone Co., the leading producer of crushed granite in the State, crushed granite at its Pacolet and Fair Forest quarries. Output from Pacolet increased 34 percent in tonnage and 8 percent in value over 1958. Substantial production was reported for the first year from Fair Forest. Material from both quarries was used primarily for roadstone and concrete. Green Construction Co. (Inman quarry) crushed granite for use as base material in the Interstate Highway construction program; the company reported for the first year. Paco Products Co. produced quartz and crude feldspar from Campbell Limestone Co. screenings at the Pacolet quarry, and the material was shipped out of State. The company also ground feldspar for use by the glass industry. Zonolite Co. mined crude vermiculite and operated an exfoliating plant near Travelers Rest. American Vermiculite Co., of Roan Mountain, Tenn. (Propst mine), mined vermiculite and hauled the material by truck to its own exfoliating plant in an adjoining county. Joe L. Snyder (Pigeon and Williams mines) and Phillips Mica Co. (Ade mine) sold small quantities of sheet mica to the GSA Mica Purchasing Depot, Spruce Pine, N.C. Tommy Brackman produced 10 pounds of black tourmaline crystals for sale and trade to collectors and tourists. The State highway department mined 2,000 tons of paving sand valued at $900 for use in its highway program.

Sumter.—Sumter County was the second largest producer of sand and gravel in the State. Becker County Sand & Gravel Co. (Camden) was the only mineral producer in the county; tonnage and value decreased 14 and 16 percent, respectively, below 1958. A new brick and tile plant was being built near Sumter by Eastern Brick & Tile Co. The plant was expected to employ about 40 men and to begin operating in early 1960. The company was to use natural gas for fuel and get its brick clay from a 93-acre site near the plant.

Union.—Zonolite Co. mined vermiculite from mines in the area and shipped the crude ore to its Kearney plant, Laurens County, for processing. The State highway department mined paving sand for its own use; tonnage and value decreased markedly from 1958.

York.—Commercialores, Inc. (Henry Knob mine), the only producer of kyanite in the State, mined kyanite for manufacturing firebrick and tile; tonnage increased 17 percent, and value 72 percent over 1958. The State highway department mined paving sand for its own use; quantity and value decreased considerably below 1958.

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen [1] and Allen F. Agnew [2]

⁂

THE MINES, quarries, and wells in South Dakota produced mineral products valued at $48.5 million in 1959, a 17-percent increase over 1958 and a new record. The previous high was $42.3 million in 1956. The value of all nonmetals, except scrap mica, lithium minerals and lime, increased substantially over 1958. As a group, the nonmetallic minerals represented 56 percent of the value of the total State mineral production. The quantity and value of sheet mica was more than double that of 1958. Decreases were recorded in the value of beryllium concentrate and silver. Gold production increased a modest 1 percent, whereas the value of produced uranium ore increased 14 percent. Mineral fuels, coal and petroleum, represented only 1 percent of the value of the State mineral production. However, value of coal production was 13 percent greater and that of petroleum more than double that of 1958.

Employment.—Employment in the mineral industries averaged 2,450 persons throughout the year, compared with 2,475 in 1958. Average wages were $92.18 for an average workweek of 45.3 hours, compared with $88.59 and 44.7 hours, respectively, in 1958. The general- and contract-construction industries, producing a substantial part of the crushed stone and sand and gravel used in roadbuilding and heavy construction, employed an average of 8,808 workers, with an average weekly wage of $100.04; and an average workweek of 40.9 hours. The averages were 9,325 workers, $109.61, and 42.3 hours, respectively, in 1958. The weekly wage included base pay, overtime, and night differentials but did not represent take-home pay or wage rates.

Government Programs.—Sheet and hand-cobbed mica and beryllium concentrate (beryl) were purchased by the Federal Government through General Services Administration (GSA) buying station at Custer for the strategic stockpile. Purchases of columbium-tantalum concentrate (columbite-tantalite) ceased late in 1958 when the limit for the stockpile was reached. Hand-cobbed mica was processed at the station by a contractor for GSA. Beryllium concentrate, columbium-tantalum concentrate (acquired until purchases ceased), and strategic mica were shipped from the station to stockpiles.

The Office of Mineral Exploration (OME) did not approve any exploration contracts in 1959.

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TABLE 1.—Mineral production in South Dakota [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate........short tons, gross weight..	240	$129	156	$84
Clays [2]........	155	155	227	227
Coal (lignite)........	20	78	22	88
Columbium-tantalum concentrate...........pounds..	4,294	10	....	....
Feldspar..........long tons..	23,229	145	30,825	196
Gem stones........	(3)	16	(3)	20
Gold (recoverable content of ores, etc.)....troy ounces..	570,830	19,979	577,730	20,221
Gypsum........	12	49	19	78
Mica:				
Scrap..........short tons..	1,003	24	158	5
Sheet..........pounds..	16,772	68	38,775	158
Petroleum..........thousand 42-gallon barrels..	58	(4)	119	(4)
Sand and gravel........	14,705	9,179	17,775	11,058
Silver (recoverable content of ores, etc.) thousand troy ounces..	153	138	124	113
Stone........	1,395	4,095	2,721	7,243
Uranium ore..........short tons..	35,489	530	45,734	606
Value of items that cannot be disclosed: Cement, clays (bentonite), lime, lithium minerals, and values indicated by footnote 4........	....	7,555	....	9,333
Total South Dakota [5]........	....	41,534	....	48,485

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite; value included with "Items that cannot be disclosed."

[3] Weight not recorded.

[4] Figure withheld to avoid disclosing individual company confidential data.

[5] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

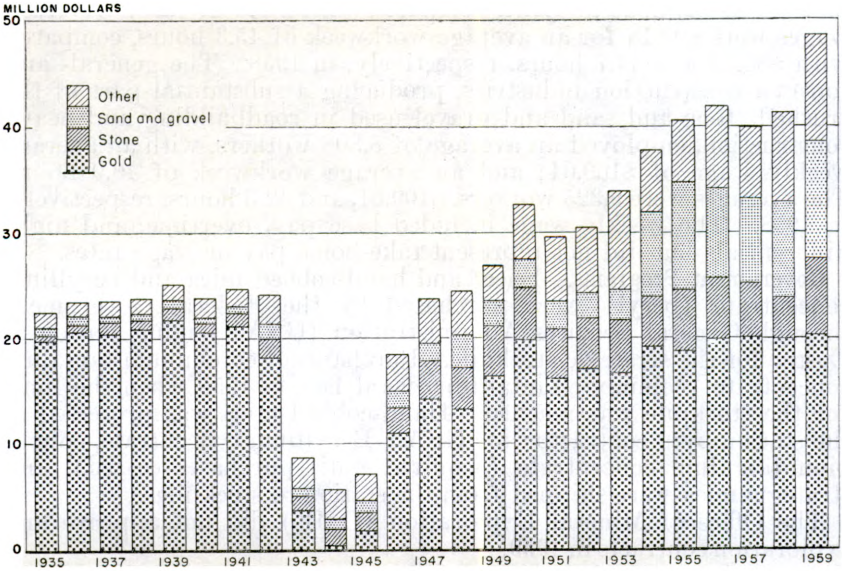

FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935–59.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of masonry and portland cements were 16 percent greater than in 1958. The average price per barrel of portland cement was $3.01, compared with $3.00 in 1958; the price for masonry cement remained unchanged at $3.76 per barrel.

Clays.—Production of miscellaneous clay in Butte County (for manufacturing of building brick, sewer tile, and other heavy clay products) and in Pennington County (for cement and lightweight aggregate) was 46 percent greater than in 1958, reflecting increased cement production. Bentonite production rose 58 percent above 1958. One company at Belle Fourche, Butte County, mined and processed bentonite from deposits in South Dakota and Wyoming. One other firm in Belle Fourche also processed bentonite but only from deposits in Wyoming.

Feldspar.—Production of feldspar from pegmatite deposits in Custer and Pennington Counties increased 33 percent above 1958. The new grinding plant at Custer, replacing the one destroyed by fire in July 1958, operated the entire year and provided an outlet for independent operators. All the output of potash feldspar was ground at the Custer plant. One operator produced soda feldspar for grinding at its plant in Illinois. The ground product from the Custer plant was shipped to consumers in Eastern, Midwestern, and Western States for use in manufacturing glass, pottery, and enamel.

Gem Stones.—Agate, rose quartz, chalcedony, petrified and agatized wood, gem varieties and specimens of beryl, cassoterite, lepidolite, and ore minerals were collected by various individuals, gem and specimen dealers, and gem societies. The greatest quantity was found in Custer County and lesser amounts in most of the other western counties. Reported value of the gems and mineral specimens collected was 25 percent greater than in 1958.

Gypsum.—Gypsum for use in manufacturing cement was mined by the South Dakota State Cement Commission from deposits in the Spearfish formation near Rapid City, Pennington County; production was 58 percent greater than in 1958.

Lime.—High-calcium limestone was mined from deposits in Custer County for manufacturing quicklime at a plant near Pringle. The entire output was used in the State for metallurgical purposes; production was 38 percent below that of 1958.

Mica.—Mica (full-trimmed, hand-cobbed, and scrap) came from 16 mines in Custer and Pennington Counties. Scrap-mica production decreased 84 percent compared with 1958, whereas the quantity of sheet mica recovered more than doubled. Scrap mica came from two mines in Pennington County, and the major portion (82 percent) of the full-trimmed and hand-cobbed mica was from mines in Custer County. Yield of block mica increased to 10.59 percent of the hand-cobbed mica processed, compared with 6.49 in 1958; however, recovery of Stained quality and Good-Stained and better decreased to 1.55 and 51.84 percent, respectively, of the hand-cobbed mica processed, compared with 2.82 and 57.26 percent in 1958. The output of hand-cobbed

TABLE 2.—Production of hand-cobbed mica and yield of sheet mica

Year	Hand-cobbed mica	Total block mica recovered		Stained quality recovered		Good-Stained and better quality recovered	
	Pounds	Pounds	Percent of hand-cobbed	Pounds	Percent of total block	Pounds	Percent of total block
1955	64,673	4,633	7.16	1,856	40.06	259	5.59
1956	216,802	12,238	5.64	7,420	60.63	253	2.07
1957	149,163	9,048	6.07	4,828	53.36	255	2.82
1958	257,198	16,681	6.49	9,552	57.26	471	2.82
1959	365,712	38,734	10.59	20,079	51.84	601	1.55

and full-trimmed mica was sold to GSA at Custer, where it was processed by a private contractor for the Government.

Sand and Gravel.—Sand and gravel production was reported from 62 of 67 counties, and increased 21 percent, compared with 1958. Commercial production was reported at 97 operations in 33 counties; production by Government-and-contractor operators was reported in 60 counties. Contractors for the State department of highways operated in 52 counties. Of the total sand and gravel produced, 92 percent was used for paving and roadbuilding; 97 percent of production by Government-and-contractor operations was used for roadbuilding.

Counties producing in excess of 500,000 tons of sand and gravel were Pennington (1,696,300), Brown (1,205,900), Minnehaha (718,300), Lake (718,300), Hughes (656,800), Brookings (631,500), Stanley (571,400), and Clark (567,500).

Stone.—Stone production—dimension granite, crushed limestone, sandstone, and miscellaneous stone—increased 95 percent in quantity

TABLE 3.—Mica sold or used by producers

	1955	1956	1957	1958	1959
Hand-cobbed mica, total:[1] Pounds	64,673	216,802	149,163	257,198	365,712
Sheet mica:[1]					
Full trimmed:					
Pounds	221	256	45	94	41
Value	$1,980	$2,010	$756	$1,393	$593
Average per pound	$8.96	$7.85	$16.80	$14.82	$14.46
From hand-cobbed mica:					
Pounds	4,633	12,238	9,048	16,678	38,734
Value	$19,403	$65,043	$44,751	$66,489	$157,234
Average per pound	$4.19	$5.31	$4.95	$3.99	$4.06
Total:					
Pounds	4,854	12,494	9,093	16,772	38,775
Value	$21,383	$67,053	$45,507	$67,882	$157,827
Average per pound	$4.41	$5.37	$5.00	$4.05	$4.07
Scrap mica, total:					
Short tons	1,322	1,268	1,626	1,003	158
Value	$26,853	$31,224	$43,142	$24,241	$4,916
Average per ton	$20.31	$24.62	$26.53	$24.17	$31.11
Total sheet and scrap mica:					
Short tons	1,324	1,274	1,631	1,011	177
Value	$48,236	$98,277	$88,649	$92,123	$162,743

[1] Sold to the Government through GSA.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

Class of operation and use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Construction sand:				
Building	346	$366	478	$529
Paving	266	237	377	351
Railroad ballast			45	24
Fill	4	2	22	11
Other	11	6	20	8
Industrial sand:				
Filtration	88	88		
Molding	(1)	2	1	5
Total sand	715	701	943	928
Construction gravel:				
Building	234	291	294	282
Paving	1,517	921	4,010	2,678
Railroad ballast	181	151	52	34
Fill	20	11	46	16
Other	9	5	(1)	(1)
Miscellaneous gravel			36	11
Total gravel	1,961	1,379	4,438	3,021
Total sand and gravel	2,676	2,080	5,381	3,949
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	49	49		
Paving	475	310	445	300
Total sand	524	359	445	300
Gravel:				
Building			399	349
Paving	11,505	6,740	11,550	6,460
Total gravel	11,505	6,740	11,949	6,809
Total sand and gravel	12,029	7,099	12,394	7,109
ALL OPERATIONS				
Sand	1,239	1,060	1,388	1,228
Gravel	13,466	8,119	16,387	9,830
Grand total	14,705	9,179	17,775	11,058

[1] Less than 1,000 tons.

and 77 percent in value, compared with 1958. Quantity of dimension granite produced in Grant County for monuments and architectural use declined slightly, compared with 1958. Production of crushed limestone, sandstone, and miscellaneous stone (used almost entirely for concrete aggregate and road construction) more than doubled that of 1958. A substantial quantity of limestone was mined from deposits in Pennington and Custer Counties for manufacturing cement and lime. Sandstone produced in Hanson and Minnehaha Counties was used as refractory stone, and in foundries and filters, manufacturing ferrosilicon, and road construction. Miscellaneous stone of undefined type was produced in 35 counties by contractors for use on State highways.

METALS

Beryllium.—Beryllium concentrate (beryl) was produced at 49 properties by 66 operators in Pennington and Custer Counties as a coproduct of feldspar and mica mining. Output, which declined 35 percent below that of 1958, was sold to GSA at Custer and to Gladys Wells of Custer who purchased small lots for resale to consumers.

The Federal Bureau of Mines continued its investigation of beryllium recovery from low-grade products by solvent extraction at its research laboratory in Rapid City.

Columbium-Tantalum.—The Government completed its purchase program of columbium-tantalum concentrate (columbite-tantalite) in 1958, and there was no reported production or sale of the mineral in 1959.

Gold and Silver.—Production of gold increased only 1 percent over that of 1958, and silver production decreased 19 percent. Homestake Mining Co., the Nation's leading gold producer, was the only gold and silver mine operating in the State at the close of the year.

Iron Ore.—The Colorado Fuel and Iron Corp. continued to drill iron deposits near Nemo, Lawrence County. The corporation announced plans to construct a $15 million beneficiation plant to upgrade the iron-bearing material when an adequate reserve of raw material was developed. It was anticipated that development of the ore bodies and construction of the plant would be completed within 7 to 8 years. No production was reported in 1959.

Uranium.—Production of uranium ore from mines in Fall River and Custer Counties advanced 29 percent in quantity and 14 percent in value, compared with 1958. The grade of ore produced declined from 0.20 percent (4.0 pounds per ton) uranium oxide to 0.19 percent (3.8 pounds per ton). The number of shippers increased from 28 in 1958 to 36 in 1959. A description [3] of the uranium-bearing formation in the Black Hills was published.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value (thousands)
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)	
1950–54 (average)	4	1	1,393	517,013	$18,095	141	$127	[3] $18,224
1955	2	--------	1,665	529,865	18,545	154	140	18,685
1956	2	--------	1,743	568,523	19,898	136	123	20,021
1957	2	--------	1,779	568,130	19,885	135	122	20,007
1958	3	--------	1,824	570,830	19,979	153	138	20,117
1959	2	--------	1,778	577,730	20,221	124	113	20,334
1876–1959	--------	--------	(4)	27,696,136	750,962	11,410	8,459	[5] 759,585

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore or old tailings shipped directly to smelters during the calendar year indicated.

[2] Does not include gravel washed.

[3] Includes 14 short tons of lead valued at $3,956.

[4] Data not available.

[5] Includes 106 short tons of copper valued at $36,466, 497 tons of lead valued at $71,752, and 265 tons of zinc valued at $56,406 produced before 1954.

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[3] Waagé, K. M., Stratigraphy of the Inyan Kara Group in the Black Hills: Geol. Survey Bull. 1081(b), 1959, pp. 11–90.

MINERAL FUELS

Coal (Lignite).—Output from a strip mine in Dewey County increased 10 percent, compared with 1958, and was consumed locally. Part of the production was crushed and oil-treated for use in stokers. Other mines producing less than 1,000 tons a year—all for local consumption—were operated in Dewey, Corson, and Perkins Counties.

Petroleum.—Petroleum production from fields in Harding and Custer Counties was more than double that of 1958. Drilling was more extensive than in the previous year, and according to data collected by the State geologist, 28 wells were completed (17 exploratory and 11 development). Some of the six exploratory wells listed as discoveries were later included in the Buffalo field in Harding County; others failed to produce oil in commercial quantities. Drilling totaled 218,758 feet. The 12–11 Tilus, located 5 miles south and slightly east of the Buffalo field, was the most significant discovery and pumped 111 barrels of oil a day. All production in Harding County has been from the Red River (Ordovician) formation at depths of approximately 8,500 feet.

REVIEW BY COUNTIES

Butte.—Bentonite, produced by American Colloid Co., was processed at the company mill at Belle Fourche. Eastern Clay Products Department, International Minerals & Chemical Corp., operated its bentonite mill at Belle Fourche and processed material from deposits in Wyoming. Miscellaneous clay was produced by Black Hills Clay Products Co. for manufacturing building brick, draintile, and other heavy clay products. Crushed stone and sand and gravel were produced by contractors for the State department of highways and the city of Belle Fourche for road construction. Butte County Highway Department produced sand and gravel for road repairs.

Custer.—Beryllium concentrate (beryl) was produced as a coproduct of feldspar and mica mining from pegmatite deposits at 36 mines by 45 operators. The major producers were Bland Mining & Milling Co. operating at the Autumn Charm, Bull Moose, Beecher No. 3, Ballard Dyke, Lucky Tin, Someday, and Tin Mountain mines; Dakota Beryllium & Oil Co. at the Red Bird lode; and Leonard E. Wood at the Lucky Strike. Most of the production was sold to the GSA purchase depot at Custer. Gladys Wells of Custer purchased small lots for resale to GSA and consumers. Feldspar production was from 64 operations at 61 mines. Abingdon Potteries, Inc., produced soda feldspar at the Townsite mine for shipment to its grinding plant in Illinois. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated the Dorothy, Shamrock, and White Elephant mines. Other producers included George Bland and Russell Wineteer at the Ballard Dyke mine, Royce McRobbie at the Rainbow, John Phepps at the Tip Top, and Ray Wineteer at the Warren Draw. The Consolidated Feldspar Department, International Minerals & Chemical Corp., operated its new mill at Custer the entire year and processed the total output of potash feldspar. The ground product was shipped to consumers in more than 20 States, Canada, and Mexico for use in manufacturing glass, pottery, and enamel.

TABLE 6.—Value of mineral production in South Dakota, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Aurora	$84,300	$52,400	Sand and gravel.
Beadle	339,200	260,919	Sand and gravel, stone.
Bennett	29,900	42,600	Sand and gravel.
Bon Homme	142,800	145,200	Do.
Brookings	217,000	486,400	Do.
Brown	345,800	783,348	Sand and gravel, stone.
Brule	42,800	37,472	Do.
Buffalo	65,900	49,900	Sand and gravel.
Butte	1,572,189	2,359,203	Clays, sand and gravel, stone.
Campbell	11,500	39,319	Sand and gravel, stone.
Charles Mix	230,800	184,236	Do.
Clark	135,600	299,806	Do.
Clay	53,900	50,027	Do.
Codington	531,800	404,795	Do.
Corson	65,800	179,200	Sand and gravel.
Custer	488,653	702,902	Uranium ore, feldspar, mica (sheet), lime, beryllium concentrate, stone, gem stones, petroleum.
Davison	118,000	129,584	Sand and gravel, stone.
Day	157,100	280,946	Do.
Deuel	64,500	45,685	Do.
Dewey	130,484	87,712	Coal.
Douglas	118,700	124,700	Sand and gravel.
Edmunds	119,600	38,600	Do.
Fall River	617,021	572,042	Uranium ore, sand and gravel, stone, gem stones.
Faulk	115,900	175,844	Sand and gravel, stone.
Grant	2,303,762	3,077,096	Stone, sand and gravel.
Gregory	284,000	121,905	Sand and gravel, stone.
Haakon	184,600	70,536	Do.
Hamlin	98,700	45,400	Sand and gravel.
Hand	93,200	28,197	Sand and gravel, stone.
Hanson	392,300	377,534	Stone, sand and gravel.
Harding	(1)	(1)	Petroleum, sand and gravel.
Hughes	173,100	481,400	Sand and gravel.
Hutchinson	143,000	55,950	Sand and gravel, stone.
Hyde	90,400	209,800	Sand and gravel.
Jackson	195,600	61,818	Sand and gravel, stone.
Jerauld	114,400	107,200	Sand and gravel.
Jones	2,300		
Kingsbury	111,300	131,714	Sand and gravel, stone.
Lake	170,300	584,075	Do.
Lawrence	20,238,118	20,477,494	Gold, silver, sand and gravel, stone.
Lincoln	525,400	179,118	Sand and gravel, stone.
Lyman	86,300	153,800	Sand and gravel.
Marshall	158,800	146,000	Do.
McCook	32,100	10,800	Do.
McPherson	157,000	146,000	Do.
Meade	225,200	76,500	Do.
Mellette	15,300	20,000	Do.
Miner	32,100	76,400	Do.
Minnehaha	854,900	1,816,926	Stone, sand and gravel.
Moody	130,300	113,500	Sand and gravel.
Pennington	7,933,023	10,531,492	Cement, stone, sand and gravel, clays, gypsum, beryllium concentrate, mica (sheet), feldspar, mica (scrap), gem stones.
Perkins	137,000	92,500	Sand and gravel.
Potter	96,000	119,844	Sand and gravel, stone.
Roberts	197,500	256,520	Do.
Sanborn	11,500	6,884	Do.
Shannon		49,500	Sand and gravel.
Spink	266,400	135,806	Sand and gravel, stone.
Stanley	95,300	334,800	Sand and gravel.
Sully	55,300	35,800	Do.
Todd	18,600	27,203	Sand and gravel, stone.
Tripp	94,900	4,324	Stone.
Turner	57,300	28,700	Sand and gravel.
Union	41,300	262,083	Sand and gravel, stone.
Walworth	118,300	159,621	Do.
Washabaugh	25,000	150	Gem stones.
Yankton	45,300	128,800	Sand and gravel.
Ziebach	22,400	6,900	Do.
Undistributed [2]	323,000	1,147,280	
Total [3]	41,534,000	48,485,000	

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[1] Figure witheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes production of some sand and gravel, lithium minerals, and gem stones that cannot be assigned to specific counties and values indicated by footnote 1.

[3] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

Full-trimmed and hand-cobbed mica, an important coproduct from pegmatite deposits, was produced from 16 operations at 12 mines. Only two operators produced full-trimmed mica. The entire output was sold to GSA purchase depot. The hand-cobbed mica was processed at the depot by a contractor for the Government, and the strategic mica recovered was reserved for the national stockpile. Scrap generated in processing was sold to grinders as it accumulated. Principal producers were York Minerals at the Red Deer mine and Kennedy and Cram at the Red Fawn. No scrap mica was reported produced or sold in 1959. High-calcium limestone was produced near Pringle for manufacturing quicklime. The entire output of quicklime was used in the State for metallurgical purposes.

Triangle Enterprises, Inc., the leading producer of uranium ore in the State, operated the Lucky Bud No. 2 mine. Ore was shipped to the plant at Edgemont for processing. Crushed rock was produced by contractors for the State department of highways for road construction. Petroleum was produced from a single well in the Barker field. Gem stones and mineral specimens, including several varieties of quartz, garnet, feldspar, chalcedony, and agate, were collected by individuals, mineral shops, and gem societies. The better grades were polished or otherwise prepared for sale as individual specimens. Lower grades were used as decorative material on art objects for sale as curios and in collections of mineral specimens characteristic of the Black Hills Region.

Fall River.—Uranium ore produced from 35 operations was shipped to the processing plant at Edgemont for recovery of uranium. Principal operators were Bear Lodge Mineral Corp. and Giant Cycle Corp., Soto and Verde mines; Chord Uranium Co., Coal Canyon No. 1, Darrow Lease, Gertrude, Get Me Rich No. 1, King, and Trail Fraction mines; Shelton Warren Oil Co., K–9 mine; Montana Chemical & Milling Corp., Gull Lease and Gull No. 3 mines; Emmet Isaacs, Hey & Fay Nos. 5 and 6 mines; and Pictograph Mining Co. and Matthew J. Brown, Dexter No. 4 mine. Mines Development, Inc., operated its 400-ton-a-day processing plant at Edgemont all year. Improvements were made in the mill to control radioactivity. Test work was begun to design a vanadium recovery unit for the plant. The uranium ore treated contained approximately 3 pounds of vanadium per ton, and recovery was expected to be 90 percent or better. Sand and gravel for building and paving was produced by four operators. Major producers were Flyte Rock Products Co. and Oral Sand Co. Contractors produced sand and gravel for road construction for the State department of highways. Specimens of agate, jasper, and petrified moss were collected by individuals and gem societies.

Grant.—Dimension granite produced at 11 quarries near Milbank and Big Stone City declined 1 percent, compared with 1958. The mahogany-brown and deep-red granites of the area were used extensively for monuments, building facings, and interior decoration. A substantial portion of the production was finished at plants in Minnesota. Major producers included Cold Spring Granite Co. (Carnelian and Melrose quarries), Dakota Granite Co. (American Rose, Bellingham, and Dakota No. 1 quarries), Delano Granite Works, Inc. (Mahogany quarry), North Star Granite Corp., and Robert Hunter

Granite Co., Inc. Walter Lindberg produced paving gravel. Paving gravel also was produced by contractors for the State department of highways.

Harding.—Petroleum production in South Dakota was almost entirely from fields in Harding County; 14 producing wells were operating at the close of the year. Most of the exploratory drilling and all development drilling were in Harding County. Exploratory drilling was significant in that the production area adjacent to the Buffalo field was extended 5 miles south. The South Dakota Oil and Gas Board defined the limits of the Buffalo field and established a spacing pattern of 160 acres. Spacing was subject to reexamination at a later date. Sand and gravel was produced by contractors for the State department of highways.

Lawrence.—Gold production increased 1 percent over 1958, and that of silver decreased 19 percent. Production of crushed limestone by Cole Construction Co. for use in sugar refining and road construction and of crushed miscellaneous stone by contractors for the State department of highways increased 51 percent; sand and gravel used for building and road construction decreased 9 percent.

Homestake Mining Co. operated its Homestake mine and amalgamation-cyanidation plant at Lead the entire year, maintaining its position as the leading gold producer in the Nation. Milled ore totaled nearly 1.75 million tons, the highest achieved in 82 years of operation. Recovery of gold and silver was 97.21 percent, or $11.52 a ton, compared with 97.13 percent and $11.37, respectively, in 1958. Direct operating costs increased only 2 cents a ton and reflected an increased productivity rate of 3.41 tons per man-shift, compared with 3.25 tons in 1958.

Ore reserve, for the first time in several years, increased by more than 0.5 million tons to a total of 13.9 million tons. Results of diamond drilling on the 4,250 level permitted the inclusion of ore between the 4,100 and 4,400 levels without the severe discount factor previously applied. The average value of the ore reserve increased by 14 cents a ton.

In February the No. 4 shaft was completed at a depth of 6,253 feet. Development continued on the 5,900 and 6,200 levels but was confined to the main ledge on the 5,900 level and the No. 9 ledge on the 6,200 level because of the high rock temperatures (113° F.) on the lowest levels. The No. 5 shaft of the long-range ventilation program was completed to the 5,000-foot level. Stripping of the Oro Hondo shaft

TABLE 7.—Ore milled, receipts, and dividends, Homestake mine[1]

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousands)
		Total (thousands)	Per ton	
1955	1, 550	$18, 055	$11. 65	$4, 019
1956	1, 628	19, 354	11. 89	4, 019
1957	1, 660	19, 479	11. 74	4, 019
1958	1, 725	19, 611	11. 37	4, 019
1959	1, 746	20, 120	11. 52	4, 019

[1] From 1876 to 1959, inclusive, this mine yielded bullion and concentrates that brought a net return of $678.5 million and paid $206.9 million in dividends.

was to begin in 1960 and the entire ventilation program was scheduled to be completed in 1961, permitting extensive development of the 5,900- and 6,200-foot levels. Total development in 1959 consisted of 80 feet of shaft sinking, 7,516 feet of raising, 29,138 feet of drifts and crosscuts, and 67,332 feet of diamond drilling.

The Bald Mountain Mining Co. operated the Dakota, Portland, Clinton, Decorah, and Folger mines and its 350-ton-a-day all-slime cyanide plant at Trojan until July, when operations were suspended for an indefinite period. The average value of the ore mined and milled was only slightly more than $5 a ton, and constantly increasing operating costs made the suspension necessary.

Pennington.—The county ranked second in the State in the value of various minerals and mineral products. Beryllium concentrate (beryl) was produced at 13 properties from 21 operations as a coproduct in the mining of feldspar and mica. The quantity recovered was 38 percent below that of 1958. Major producers were Keystone Feldspar & Chemical Co., Peerless lode; Thomas M. Edson, also at the Peerless lode; Elmer C. Harris, Peerless dump; McCarty-Pullen Mines, White Cap mine; Mylett Mining Account, Sackett Fraction lode; and Walter Hough, High Climb mine. These operators produced 85 percent of the beryl in the county, nearly all of which was sold to GSA at Custer. Gladys Wells purchased small lots for resale to GSA and to consumers. Feldspar was produced at seven mines and sold to Consolidated Feldspar Department, International Minerals & Chemical Corp., at Custer for grinding. Principal producers were Walter Hough at the High Climb mine and McCarty-Pullen Mines at the White Cap. Mica was produced at four mines, and hand-cobbed mica output was 48 percent greater than in 1958. Major producers were McCarty-Pullen Mines at the White Cap mine and Thomas M. Edson at the Peerless lode. Glen Ventling produced a small quantity of full-trimmed mica at the Dike lode. All hand-cobbed and full-trimmed mica was sold to GSA. Scrap mica produced at the Peerless lode by Thomas M. Edson and at the White Cap mine by McCarty-Pullen Mines was 83 percent below that of 1958; all was sold to grinders.

Shipments of portland and masonry cements by South Dakota State Cement Commission at Rapid City increased 16 percent, compared with 1958. The Commission produced the limestone, shale, sand, and gypsum used at the plant from deposits near Rapid City. Cement clinker was used as a base in manufacturing masonry cement. Shipments were made to consumers throughout South Dakota and to the adjoining States of North Dakota, Wyoming, Montana, Nebraska, and Minnesota. Small shipments also were made to Colorado and Illinois.

Miscellaneous clay was mined from the Pierre formation near Rapid City for manufacturing lightweight aggregate. Light Aggregates, Inc., operated its bloating plant at Rapid City, and the entire output was used as a concrete aggregate and in manufacturing building blocks. The county led the State in the production of sand and gravel. Production in 1959 was 1.7 million tons, more than double that of the previous year. Approximately half of the 1959 production was by contractors for the State department of highways, Federal agencies, and the county highway department. Principal producers were Rounds Construction Co., Floyd Stapp Construction Co., and Birdsall Sand & Gravel Co.

Crushed limestone for riprap, road construction, concrete aggregate, and railroad ballast was produced by three operators, Hills Materials Co., L. G. Everist, Inc., and Pete Lien & Sons. The latter company began constructing a modern aggregate plant at Rapid City, designed to produce all sizes of sand, gravel, and crushed rock for use in building, heavy construction, and highways.

Gem stones and mineral specimens were collected by individuals and gem societies from the various mineral deposits in the county. Most of the material collected was sold to tourists as specimens and curios; the better grades were polished.

The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Tennessee Division of Geology.

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RECORD production of copper, zinc, portland cement, crushed limestone, and sand and gravel highlighted the mineral industry of Tennessee in 1959. Coal production continued to decline, reaching the lowest level since 1953. Tennessee led the Nation in production of ball clay, dimension marble, pyrite, and zinc; ranked second in phosphate rock; third in fuller's earth; and fifth in production

TABLE 1.—Mineral production in Tennessee[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement:				
Masonry ......thousand 376-pound barrels	697	$2,439	772	$2,743
Portland ......do	7,678	23,969	8,381	26,191
Clays	935	4,210	1,146	4,952
Coal	6,785	25,969	5,913	23,581
Copper (recoverable content of ores, etc.) ...short tons	9,109	4,791	11,490	7,055
Gem stones	(2)	1	(2)	(3)
Gold (recoverable content of ores, etc.) ....troy ounces	124	4	99	3
Iron ore ......gross weight, long tons	-----	-----	21,346	111
Manganese ore (35 percent or more Mn) gross weight, short tons	5,935	452	7,586	589
Manganiferous ore (less than 35 percent Mn) gross weight, short tons	-----	-----	56	1
Natural gas ......million cubic feet	54	9	[4] 60	[4] 10
Phosphate rock ......thousand long tons	1,903	13,041	1,755	13,255
Sand and gravel	5,612	6,671	6,221	7,570
Silver (recoverable content of ores, etc.) ...troy ounces	44,592	40	59,739	54
Stone	[5] 16,850	[5] 26,814	18,767	29,094
Zinc (recoverable content of ores, etc.) ......short tons	59,130	12,062	89,932	20,684
Value of items that cannot be disclosed: Barite, lime, mica, petroleum, pyrite, and stone (dimension limestone, 1958, and crushed sandstone, 1958)	-----	6,884	-----	7,392
Total Tennessee[6]	-----	124,934	-----	140,739

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Less than $1,000.
[4] Preliminary figure.
[5] Excludes dimension limestone and crushed sandstone, included with "Value of items that cannot be disclosed."
[6] Total adjusted to eliminate duplicating the value of clays and stone.

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of mica. The total value of production increased 13 percent over 1958 and 2 percent over 1956, the previous peak year.

Leading industries were stone quarrying, cement manufacturing, production of copper and zinc, coal mining, and mining and processing of phosphate rock, which together furnished 87 percent of the total value of production, the same as in 1958. Leading companies were: Tennessee Copper Co. (gold, silver, copper, pyrite, and zinc), Penn-Dixie Cement Corp. (cement, limestone, and clay), American Zinc Co. of Tennessee (zinc and limestone), Volunteer Portland Cement Co. (cement, limestone, and clay), and New Jersey Zinc Co. (zinc and limestone).

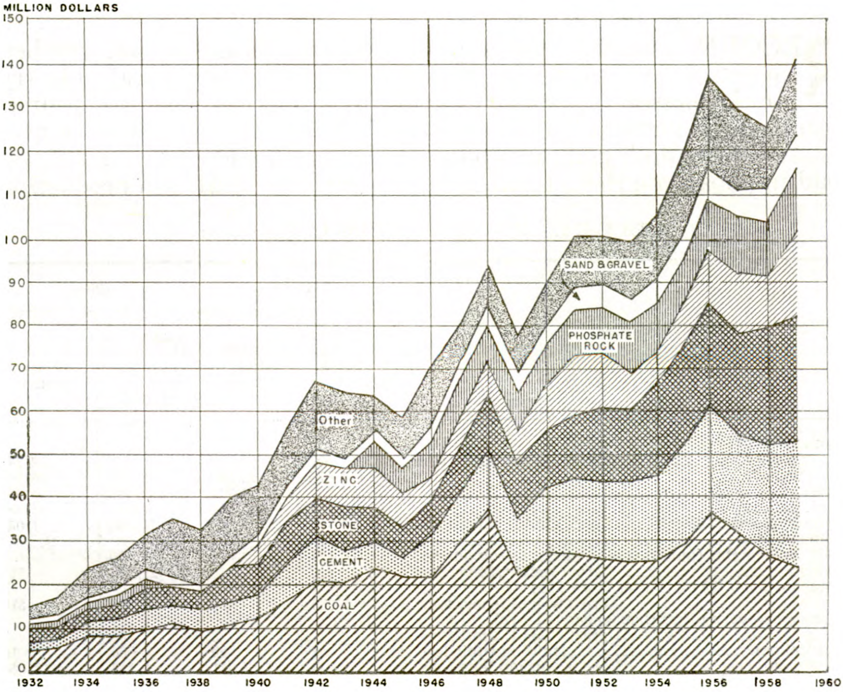

FIGURE 1.—Value of mineral production in Tennessee, 1932–59.

Employment and Injuries.—Total employment in the mineral industries increased 13 percent, due mainly to increased employment at coke ovens and smelters. Employment at coal mines declined 22 percent below 1958 and 34 percent below 1957; number of men working daily dropped 1,017 below 1958 and 2,117 below 1957.

Injury experience was about the same. Increased frequency rates were recorded by quarries and mills and by coal mines. There were 25 fatalities, compared with 23 in 1958 and 14 in 1957.

The leading causes of injuries in the mineral industries were: Handling materials, machinery, haulage, falls of roof, and falls of persons. Causes of fatalities were: Gas explosions (9), falls of roof (7), haulage (3), machinery (1), falls of face (1), electricity (1), and drowning (1).

A major disaster occurred at the No. 1 mine of Phillips & West Coal Co. near Robbins, in Scott County. A gas explosion resulted in the deaths of nine men, the entire crew underground at the time.

Trends and Developments.—Rapid expansion of the East Tennessee zinc district was the outstanding development of the year. Development of two new large zinc mines by New Jersey Zinc Co. and increased exploration and development by the other two companies active in the field resulted in recognition of this district as the leading zinc district in the Nation.

TABLE 2.—Employment and injuries in the mineral industries

Industry	Operations	Men working daily	Average active	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
				1958			
Coke ovens and smelters	3	4,423	354	12,521,398		62	5
Quarries and mills	131	3,391	251	6,823,937	1	156	23
Coal mines	690	5,075	148	6,477,790	16	220	37
Metal mines	22	1,444	238	2,750,226	4	56	25
Nonmetal mines	43	1,278	266	2,721,353		33	12
Sand and gravel mines	40	744	259	1,494,525	2	29	21
Total	929	16,355	246	32,789,229	23	556	18
				1959 [1]			
Coke ovens and smelters	3	6,141	360	17,683,379		70	4
Quarries and mills	134	3,378	264	7,139,869	2	219	31
Coal mines	576	4,058	155	5,041,500	18	189	41
Metal mines	26	1,543	243	3,005,252	2	76	26
Nonmetal mines	44	1,755	192	2,699,924	2	68	26
Sand and gravel mines	44	698	279	1,556,865	1	24	16
Total	827	17,573	264	37,126,789	25	646	18

[1] Preliminary figures.

The National System of Interstate and Defense Highways Program was partly responsible for record production of aggregates. Of a total of 1,047 miles of four-lane limited-access highways designated for the State, 10 miles were completed during the year, 89 miles were under construction, plans were approved for 24 miles, and 51 miles were programed.

Legislation and Government Programs.—The State government merged the former Department of Conservation with the Tennessee Industrial and Agricultural Commission and formed the new Department of Conservation and Commerce. The new Department was organized in two sections: The Conservation Section, consisting of the Forestry Division, the Geology Division, the Water Resources Division, the State Parks Division, the Hotel and Restaurant Inspection Division, and the State Information and Tourist Promotion Division; and the Industrial Section, consisting of the Industrial Development Division, the Industrial Research Division, the Industrial Advertising and

TABLE 3.—Injuries in the mineral industries, by causes

Cause	Coke ovens and smelters	Quarries and mills	Coal mines	Metal mines	Non-metal mines	Sand and gravel mines	Total
				1958			
Handling materials	14	31	45	11	5	8	114
Machinery	21	8	[1] 41	14	6	3	93
Haulage	5	[1] 10	[1] 44	9	6	[1] 8	82
Falls of roof	-	1	[2] 47	[1] 5	-	-	53
Falls of persons	5	14	11	[1] 8	5	6	49
Hand tools	5	14	13	3	2	1	38
Falling objects	6	12	3	[1] 3	3	-	27
Falls of face	-	7	8	4	-	-	19
Explosions	-	-	1	[1] 2	-	-	3
Electricity	-	4	6	-	-	-	10
Miscellaneous	6	56	17	1	6	[1] 5	91
Total	62	157	236	60	33	31	579
				1959 [3]			
Handling materials	17	-	46	10	16	7	96
Machinery	19	-	26	24	[1] 7	4	80
Haulage	8	-	[4] 42	6	[1] 15	5	76
Falls of roof	-	-	[5] 37	[4] 10	1	-	48
Falls of persons	7	-	4	11	12	2	36
Hand tools	7	-	10	4	3	1	25
Falling objects	2	-	9	6	2	1	20
Falls of face	-	-	[1] 7	3	-	-	10
Explosions	-	-	[6] 9	-	-	-	9
Electricity	1	-	[1] 3	-	2	-	6
Explosives	-	-	4	-	-	-	4
Miscellaneous	9	-	10	4	12	[1] 5	40
Undetermined	-	[4] 221	-	-	-	-	221
Total	70	221	207	78	70	25	671

[1] 1 fatality. [2] 14 fatalities. [3] Preliminary figures. [4] 2 fatalities. [5] 5 fatalities. [6] 9 fatalities.

Promotion Division, the Finance Committee, the Community Development Division, and the Nuclear Energy Development Division.

The Bureau of Mines operated the Norris Metallurgy Research Laboratory and the Office of Mineral Resources at Knoxville.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—McMinn Barium Corp., National Lead Co., and Smith Mines, Inc., mined crude barite in Loudon, McMinn, and Monroe Counties for oil-well-drilling muds, glass manufacturing, and other uses. Production declined 20 percent below 1958 and 90 percent below 1941, the record year, to the lowest level since 1933.

Cement.—Four companies produced masonry cement at five plants in five counties. The leading producer was Marquette Cement Manufacturing Co. Shipments increased 11 percent but were 3 percent below the record of 1955. Consumption in Tennessee was 56 percent, and shipments were made to North Carolina (19 percent), Georgia (10 percent), South Carolina (8 percent), Alabama (2 percent), Kentucky (1 percent), and other States (4 percent).

Four companies produced portland cement at six plants in six counties. The leading producer was Penn-Dixie Cement Corp. Shipments expanded 9 percent over 1958 and 4 percent over 1956, the previous record year. Raw materials used in cement included limestone (85 percent), clay and shale (9 percent), gypsum (3 percent), and other (3 percent). Consumption in Tennessee was 39 percent, and shipments were made to North Carolina (29 percent), Georgia (19 percent), South Carolina (4 percent), Alabama (3 percent), Kentucky (2 percent), Florida (1 percent), and other States (3 percent).

A special study of the end uses of portland cement showed the following uses: Ready-mixed concrete (54 percent), concrete products (19 percent), building-material dealers (12 percent), highway contractors (9 percent), other contractors (4 percent), Government agencies (1 percent), and other (1 percent).

During the year Ideal Cement Co. acquired Volunteer Portland Cement Co. Marquette Cement Manufacturing Co. announced an expansion program for its Nashville plant.

TABLE 4.—Finished portland cement produced, shipped, and in stock, in 376-pound barrels

(Thousand barrels and thousand dollars)

Year	Production (quantity)	Shipments from mills		Stocks at mills on Dec. 31
		Quantity	Value	
1950–54 (average)	7,269	7,220	17,547	442
1955	8,110	8,017	21,176	362
1956	8,386	8,050	23,014	476
1957	7,181	6,776	20,592	684
1958	7,923	7,678	23,969	665
1959	8,688	8,381	26,191	695

Clays.—Six companies mined ball clay at seven mines in Henry and Weakley Counties. Leading producers were H. C. Spinks Clay Co., Inc., and United Clay Mines Corp. Production increased 20 percent over 1958 and 5 percent over 1956, the previous record year. Tennessee led the Nation in production of ball clay.

Southern Clay Co., Inc., and Tennessee Absorbent Clay Co. mined fuller's earth in Henry County for absorbent uses. Production increased 9 percent but was 37 percent below the record of 1956. Among the States, Tennessee ranked third in production of fuller's earth.

Thirteen companies mined miscellaneous clay at 15 mines in 10 counties for floor and wall tile, heavy clay products, lightweight aggregate, and cement. Leading counties were Knox and Sullivan; leading producers were General Shale Products Corp. and W. G. Bush & Co., Inc. Production expanded 24 percent but was 22 percent below the record of 1956.

At Gleason, W. G. Bush & Co., Inc., started construction of a new brick plant with a planned capacity of 17 million bricks per year. General Shale Products Corp. completed another kiln at the Kingsport plant with an annual capacity of 20 million bricks.

Feldspar.—The Feldspar Corp. ground crude feldspar from North Carolina at its Erwin plant.

TABLE 5.—Ball clay sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Whiteware, etc	162,234	$2,235,155	$13.78	207,132	$2,833,601	$13.68
Floor and wall tile	45,825	657,206	14.34	56,236	775,395	13.79
Heavy clay products	2,963	29,630	10.00	3,456	34,560	10.00
Art pottery	(1)	(1)	(1)	180	2,376	13.20
Other uses [2]	41,411	619,054	14.95	36,184	517,807	14.31
Total	252,433	3,541,045	14.03	303,188	4,163,739	13.73

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."

[2] Includes firebrick and block, glass refractories, saggers, pins, stilts, and wads, exports, and other uses.

Gem Stones.—P. H. Moore and Willard Pratt collected mineral specimens for sale as souvenirs (barite, unakite, dolomite, and quartz).

Lime.—Standard Lime & Cement Co., Williams Lime Manufacturing Co., and Victor Chemical Works produced quicklime and hydrated lime at Knoxville and Nashville for building, chemical, and industrial use. Production was 31 percent more than in 1958. Consumption in Tennessee was 29 percent, and shipments were made to North Carolina (39 percent), Kentucky (12 percent), Georgia (8 percent), Florida (2 percent), South Carolina (1 percent), and other States (9 percent).

Mica.—International Minerals & Chemical Corp. recovered scrap mica from silt deposits in Davy Crockett Lake. Production was nearly three times the record of 1958. Among the States, Tennessee ranked fifth in production of mica.

Perlite.—Tennessee Products & Chemical Corp. expanded crude perlite from Western States at the Nashville plant.

Phosphate Rock.—Nine companies mined and processed phosphate rock in Maury, Williamson, Giles, Davidson, and Hickman Counties. Leading producers were Monsanto Chemical Co. and Victor Chemical Works. Marketable production decreased 8 percent below the record of 1958. Among the States, Tennessee ranked second in production of phosphate rock.

During the year, International Minerals & Chemical Corp. completed an expansion program at its Wales plant. Victor Chemical Works started construction of a fifth electric furnace at Mount Pleasant. Monsanto Chemical Co. completed an expansion program at its Columbia plant. Stauffer Chemical Co. acquired Victor Chemical Works, which will operate as the Victor Chemical Division.

Pyrite.—Tennessee Copper Co. recovered pyrite concentrate from sulfide ore mined in Polk County. Production increased 12 percent over 1958 and was about the same as in 1957, the record year. Tennessee led the Nation in production of pyrite.

Sand and Gravel.—Thirty-nine companies mined sand and gravel at 44 mines in 27 counties. Leading counties were Shelby, Benton, and

TABLE 6.—Phosphate rock sold or used by producers, by uses

(Thousand long tons and thousand dollars)

Use	1958		1959	
	Quantity	Value	Quantity	Value
Elemental phosphorus	1,609	11,443	1,594	11,747
Ordinary superphosphate	[1] 100	[1] 544	[2] 90	[2] 748
Direct application to the soil	96	522	70	592
Fertilizer filler	[3] 114	[3] 623	21	179
Other [4]	4	28		
Total	1,923	13,160	1,775	13,266

[1] Includes triple superphosphate.
[2] Includes phosphoric acid (wet process).
[3] Includes other fertilizers.
[4] Includes pig-iron blast furnace and other uses.

Davidson. Leading producers were Memphis Stone & Gravel Co., Inc., Cumberland River Sand & Gravel Co., and Sangravl, Inc. Production increased 11 percent over 1958 and 11 percent over the record of 1956. Of the total production, 87 percent was washed, 65 percent was hauled by truck, 25 percent by rail, and 10 percent by water.

American-Saint Gobain Corp. announced it would construct a new plate-glass plant at Kingsport.

TABLE 7.—Sand and gravel sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Benton	650,173	$1,033,617	794,493	$1,284,016
Cumberland	--------	--------	55,000	68,940
Davidson	(1)	(1)	(1)	(1)
Decatur	45,000	45,000	(1)	(1)
Fayette	58,185	58,000	68,200	56,600
Franklin	(1)	(1)	52,801	88,900
Giles	55,000	50,000	67,500	56,025
Greene	(1)	(1)	35,477	53,798
Hamilton	(1)	(1)	(1)	(1)
Hardeman	--------	--------	18,870	14,660
Haywood	98,000	90,000	86,780	65,000
Henderson	(1)	(1)	(1)	(1)
Humphreys	(1)	(1)	(1)	(1)
Knox	(1)	(1)	(1)	(1)
Lauderdale	49,000	40,000	53,442	44,350
Loudon	18,741	33,884	20,103	26,170
Macon	16,854	16,854	--------	--------
McNairy	(1)	(1)	(1)	(1)
Monroe	14,615	18,799	9,740	11,883
Obion	140,000	51,999	124,900	103,600
Perry	25,000	10,000	--------	--------
Putnam	--------	--------	60,700	63,700
Shelby	1,697,668	1,565,975	1,734,113	1,716,982
Stewart	--------	--------	(1)	(1)
Sumner	101,000	37,500	101,000	37,500
Tipton	(1)	(1)	(1)	(1)
Unicoi	272,522	349,424	293,553	392,495
Warren	--------	--------	22,887	28,602
Wayne	(1)	(1)	(1)	(1)
Undistributed	2,369,851	3,269,873	2,621,434	3,457,084
Total	5,611,609	6,670,925	6,220,993	7,570,305

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

TABLE 8.—Sand and gravel sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,218,132	$1,489,945	$1.22	1,883,801	$2,327,055	$1.24
Paving	583,737	776,077	1.33	469,031	498,639	1.06
Molding	(1)	(1)	(1)	266,949	784,440	2.94
Engine	1,045	1,306	1.25	660	825	1.25
Other [2]	387,029	1,013,841	2.62	261,026	533,562	2.04
Total	2,189,943	3,281,169	1.50	2,881,467	4,144,521	1.44
Gravel:						
Structural	1,034,475	1,392,671	1.35	1,835,048	2,147,006	1.17
Paving	2,196,140	1,828,368	.83	1,337,255	1,110,970	.83
Railroad ballast	82,306	80,000	.97	109,999	111,623	1.01
Other	108,745	88,717	.82	57,224	56,185	.98
Total	3,421,666	3,389,756	.99	3,339,526	3,425,784	1.03
Total sand and gravel	5,611,609	6,670,925	1.19	6,220,993	7,570,305	1.22

[1] Figure withheld to avoid disclosing individual company confidential data, included with "Other."
[2] Includes glass, grinding, furnace, fill, and other sands.

Stone.—Blue Ridge Stone Co. crushed 40,000 tons of granite in Carter County for concrete and roads. Seventy-five operators crushed limestone at 98 quarries in 53 counties. Leading counties were Davidson, Knox, and Marion. Leading producers were Lambert Brothers Division of Vulcan Materials Co. (Blount, Davidson, Hawkins, Humphries, Knox, Roane, Sevier, Sullivan, and Williamson Counties), Chattanooga Rock Products Division of Vulcan Materials Co. (Hamilton and Marion Counties), and American Zinc Co. of Tennessee (Jefferson and Knox Counties). Output was 11 percent more than the record of 1958. Of the total production, 89 percent was hauled by truck, 8 percent by rail, and 3 percent by water. H. R. Fipps & Son quarried 620 tons of dimension limestone (rubble) in Sevier County.

John J. Craig Co. (Hamil, Marmor, Crisp, and Lee quarries), Appalachian Marble Co. (Bond and Appalachian quarries), and Knoxville Crushed Stone Co. (Stone Road quarry) crushed marble for terrazzo and other uses. Production declined 26 percent below 1958 and 51 percent below the record of 1948. Five companies quarried dimension marble at 12 quarries in Blount, Knox, and Union Counties. The leading producers were John J. Craig Co. and Tennessee Marble Co. Division of Georgia Marble Co. Production decreased 7 percent below 1958 and 11 percent below the record of 1957. Tennessee led the Nation in production of dimension marble. During the year Georgia Marble Co. acquired Endsley Marble Co.

Silica Sand Co., Inc., Major Sand Co., Inc., and Turner Bros. Stone Co., Inc., crushed 70,500 tons of sandstone for refractories, concrete and roads, abrasives, and cement.

Twelve companies quarried dimension sandstone at 12 quarries in Cumberland and Fentress Counties for rough architectural, sawed,

TABLE 9.—Crushed limestone sold or used by producers, by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Anderson	(1)	(1)	(1)	(1)
Bedford	(1)	(1)	(1)	(1)
Blount	(1)	(1)	409, 346	$409, 346
Bradley	(1)	(1)	(1)	(1)
Campbell	347, 269	$396, 600	(1)	(1)
Cannon	(1)	(1)	25, 000	30, 000
Carter	(1)	(1)	(1)	(1)
Cocke	54, 060	80, 076	42, 000	48, 480
Coffee	(1)	(1)	(1)	(1)
Cumberland	(1)	(1)	(1)	(1)
Davidson	1, 634, 560	1, 971, 422	2, 275, 800	2, 727, 495
Decatur	120, 000	144, 000	220, 000	257, 000
De Kalb	26, 620	26, 620	45, 348	45, 348
Dickson	(1)	(1)	(1)	(1)
Fayette	9, 500	18, 690	39, 647	105, 000
Fentress	178, 000	222, 000	137, 800	159, 200
Franklin	627, 266	700, 879	634, 332	733, 669
Giles	(1)	(1)	240, 000	336, 000
Grainger	14, 369	17, 272	----------	----------
Greene	(1)	264, 500	(1)	(1)
Grundy	22, 000	25, 000	26, 000	28, 000
Hamblen	(1)	(1)	239, 823	330, 559
Hamilton	(1)	(1)	(1)	(1)
Hawkins	(1)	(1)	37, 390	53, 542
Humphreys	(1)	(1)	630, 893	849, 750
Jefferson	(1)	(1)	(1)	(1)
Johnson	(1)	(1)	(1)	(1)
Knox	1, 794, 665	2, 249, 095	1, 820, 464	2, 073, 257
Lincoln	(1)	(1)	(1)	(1)
Macon	(1)	(1)	72, 477	108, 717
Marion	1, 055, 418	1, 447, 210	966, 944	1, 370, 440
Marshall	(1)	(1)	(1)	(1)
Maury	(1)	(1)	(1)	(1)
McMinn	(1)	(1)	(1)	(1)
Meigs	(1)	(1)	(1)	(1)
Monroe	103, 065	145, 000	105, 000	147, 000
Montgomery	(1)	(1)	(1)	(1)
Perry	----------	----------	18, 163	25, 770
Putnam	----------	----------	302, 000	377, 500
Rhea	104, 000	142, 000	(1)	(1)
Roane	(1)	(1)	(1)	(1)
Robertson	(1)	(1)	(1)	(1)
Rutherford	381, 796	477, 245	(1)	(1)
Sequatchie	107, 175	150, 936	(1)	(1)
Sevier	(1)	(1)	121, 527	174, 491
Smith	(1)	(1)	(1)	(1)
Stewart	----------	----------	(1)	(1)
Sullivan	(1)	(1)	659, 965	908, 458
Sumner	261, 138	334, 020	(1)	(1)
Union	38, 900	37, 440	----------	----------
Warren	(1)	(1)	(1)	(1)
Washington	199, 674	249, 592	211, 146	263, 932
White	341, 956	482, 131	(1)	(1)
Williamson	(1)	(1)	307, 522	387, 108
Wilson	(1)	(1)	492, 451	541, 994
Undistributed	9, 234, 739	12, 119, 998	8, 455, 636	10, 980, 438
Total	16, 656, 170	21, 701, 726	18, 536, 674	23, 472, 494

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

and dressed building stone and for flagging. Leading producers were Tennessee Stone Co., Inc., and Crab Orchard Stone Co., Inc. Production decreased 22 percent below 1958 and 30 percent below the record of 1955.

Vermiculite.—Zonolite Co. exfoliated vermiculite from South Carolina and Montana at its Nashville plant.

TABLE 10.—Crushed limestone sold or used by producers, by uses

Use	1958			1959		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Concrete and roads	13,076,145	$16,701,133	$1.28	14,360,894	$18,109,353	$1.26
Cement and lime	2,067,835	2,382,821	1.15	2,257,092	2,479,139	1.10
Agstone	651,283	928,568	1.43	1,118,476	1,617,692	1.45
Railroad ballast	368,215	436,717	1.19	243,019	311,574	1.28
Stone sand	50,046	77,648	1.55	164,154	240,967	1.47
Riprap	7,014	7,108	1.01	(1)	(1)	(1)
Filter beds	(1)	(1)	(1)	2,400	5,400	2.25
Other [2]	435,632	1,167,731	2.68	390,639	708,369	1.81
Total	16,656,170	21,701,726	1.30	18,536,674	23,472,494	1.27

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

[2] Includes fluxing stone, glass, paper, whiting, asphalt filler, fertilizer filler, rock dust for coal mines, mineral food, and other uses.

TABLE 11.—Dimension marble sold or used by producers, by uses

Use	1958			1959		
	Cubic feet	Value		Cubic feet	Value	
		Total	Average unit value per cubic foot		Total	Average unit value per cubic foot
Building stone:						
Interior, rough	191,775	$582,208	$3.04	170,578	$424,114	$2.49
Interior, sawed, dressed	119,429	984,449	8.24	126,993	1,080,077	8.51
Interior, cut, dressed	101,326	1,775,264	17.52	(1)	(1)	(1)
Other uses [2]	187,874	145,814	.78	262,769	2,191,795	8.34
Total	600,404	3,487,735	5.81	560,340	3,695.986	6.60

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other uses."

[2] Includes exterior sawed and cut building stone, and dressed, sawed, monumental stone.

MINERAL FUELS

Coal.—Bituminous coal was mined at 480 mines in 17 counties, compared with 500 mines in 18 counties in 1958. Leading counties were Marion, Anderson, and Morgan. Leading mines were the Dean mine (Windrock Coal & Coke Co. Division of Bessemer Coal, Iron & Land Co.), Meadow Creek mine (Clinchfield Coal Co.), Coal Valley mine (Tennessee Consolidated Coal Co.), and the Reels Cove mine (Tennessee Products & Chemical Corp.). Production decreased 13 percent below 1958 and 33 percent below the record of 1956, to the lowest level since 1953. All decrease was in the northern part of the State (District 8). Average production per mine decreased from 13,600 to 12,300 tons.

In the northern part of the State (District 8), 292 mines in 9 counties produced 3,491,000 tons of coal, compared with 304 mines, 10 counties, and 4,516,000 tons in 1958. Average production per mine decreased from 14,900 to 12,000 tons. Underground mines produced

65 percent of the total, strip mines 28 percent, and auger mines 7 percent. Shipments were 52 percent by rail or water and 48 percent by truck. Captive tonnage was 3 percent of the total.

Windrock Coal & Coke Co. Division of Bessemer Coal, Iron & Land Co. installed the first underground coal-recovery auger in the United States at the Dean mine. The auger was 34 inches in diameter, and produced 100 tons of coal per shift.

Equipment used at 224 underground mines included 90 cutting machines, which cut 79 percent of the total; 124 power drills, which drilled 82 percent; 57 locomotives, 49 shuttle cars, 7 rope hoists, and 6 mother conveyors; 16 mobile loading machines, which loaded 49 percent; 1 continuous-mining machine (coal-recovery auger), which loaded 1 percent; and 14 face conveyors, which loaded 5 percent. Equipment used at 57 strip mines included 73 power shovels, 2 draglines, 1 carryall scraper, 53 bulldozers, 22 power drills, and 147 trucks. An estimated 5,084,000 cubic yards of overburden was excavated. Equipment used at 11 auger mines included 11 coal-recovery augers, 9 bulldozers, 1 power drill, and 17 trucks. Coal cleaned at one cleaning plant was 1 percent of the total. Ten percent of the coal was crushed.

TABLE 12.—Coal production by counties

County	1958		1959	
	Short tons	Value	Short tons	Value
Anderson	1,302,324	$4,847,254	1,067,197	$4,582,788
Bledsoe	30,546	133,312	40,649	142,271
Campbell	805,910	2,671,363	470,309	1,631,833
Claiborne	280,216	1,105,165	158,494	691,637
Cumberland	85,789	293,964	107,007	367,789
Fentress	78,971	204,967	122,644	381,340
Grundy	148,131	516,079	173,837	695,651
Hamilton	84,182	257,441	46,765	156,292
Marion	1,385,514	6,412,252	1,607,002	7,120,618
Morgan	692,205	2,807,526	551,248	2,242,035
Overton	75,241	236,067	92,089	276,267
Putnam	395,463	1,669,333	409,956	1,721,553
Rhea	189,715	445,830	127,147	298,795
Roane	2,500	10,350	----------	----------
Scott	797,653	2,951,486	511,882	1,954,209
Sequatchie	338,915	1,106,463	345,370	1,070,673
Van Buren	75,482	241,680	70,623	223,261
White	15,663	58,654	10,505	23,636
Total	6,784,600	25,969,186	5,912,724	23,580,648
Earliest record to date	382,585,000	(1)	388,498,000	(1)

[1] Data not available.

In the Southern part of the State (District 13), 188 mines in 8 counties produced 2,422,000 tons, compared with 196 mines, 8 counties, and 2,268,000 tons in 1958. Average production per mine increased from 11,600 to 12,900 tons. Underground mines produced 80 percent of the total, strip mines 16 percent, and auger mines 4 percent. Shipments were 76 percent by rail or water and 24 percent by truck. All coal was sold in open market, mainly to Tennessee Valley Authority.

Equipment used at 174 underground mines included 108 cutting machines, which cut 75 percent of the total; 161 power drills, which drilled 85 percent; 47 locomotives, 5 shuttle cars, 1 rope hoist, and 13 mother conveyors; 12 mobile loading machines, which loaded 18 percent; and 12 conveyors, which loaded 13 percent. Equipment used at 12 strip mines included 21 power shovels, 4 draglines, 16 bulldozers, 7 power drills, and 21 trucks. An estimated 5,910,000 cubic yards of overburden was excavated. Equipment used at 2 auger mines included 2 coal-recovery augers and 2 trucks. Of the total tonnage, 7 percent was crushed. None of the coal was treated.

Coke.—Tennessee Products & Chemical Corp. produced metallurgical coke at byproduct coke ovens in Chattanooga.

Natural Gas.—Marketed production of natural gas increased 11 percent. Production was from Scott and Morgan Counties (54 million cubic feet), and Fentress County (6 million cubic feet). Cumulative production of natural gas for the State since 1916 was 3,242 million cubic feet.

Petroleum.—Production of crude petroleum decreased 16 percent below 1958 and 63 percent below the record of 1953. Crude petroleum was produced in Morgan and Scott Counties (65 percent), Clay (10 percent), Pickett (10 percent), Claiborne (8 percent), Jackson (6 percent), and Robertson (1 percent). Cumulative production since 1916 was 609,000 barrels value at $1,013,000. During the year 72 wells were drilled. Four small producing oil wells and one shut-in gas well were drilled. Total footage drilled was about 57,000 feet.

METALS

Copper.—Tennessee Copper Co. recovered copper concentrate from sulfide ore mined in Polk County. Production of recoverable copper increased 26 percent and was 9 percent above the record of 1930. Table 13 shows copper production since 1850. Tennessee Copper Co. started sinking the Cherokee shaft, which will connect with a haulage drift from the Central shaft on the 10th level. Development of the new Cherokee ore body will take about 5 years.

Ferroalloys.—Shipments of ferromanganese, silicomanganese, ferrosilicon, ferrochromium, ferrochromic silicon, and ferrophosphorus totaled 135,700 tons valued at $23,519,000, compared with 164,200 tons valued at $34,327,000 in 1958.

Gold.—Tennessee Copper Co. recovered gold as a byproduct from smelting copper and zinc concentrates. Production declined 20 percent below 1958 and 86 percent below the record of 1930.

Iron Ore.—Big Flag Springs Mining Co. and Rucker Mining Co. mined brown iron ore in Blount and McMinn Counties. Walt Mining Co. opened a new mine in Union County and shipped red iron ore to Rockwood.

Manganese Ore.—Manganese mining in Tennessee virtually ceased when the General Services Administration (GSA) stopped buying ore for stockpiles August 1, 1959. Metallurgical-grade ore was mined by 10 companies at 11 mines in Carter, Johnson, and Unicoi Counties. Leading producers were Turner Mines and Virginia Iron, Coal & Coke Co. Shipments increased 28 percent. Turner Mines produced a small quantity of manganiferous ore for fertilizer filler in Unicoi County.

Pig Iron.—Tennessee Products & Chemical Corp. produced foundry, basic, low-phosphorus, and malleable pig iron at Rockwood and Wrigley. Shipments increased 26 percent. There were no imports of foreign ores.

TABLE 13.—Mine production of recoverable copper, 1850–1959

	Short tons	Value		Short tons	Value
1850–80	29,754	$6,000,000	1921	7,542	$1,945,874
1881	100	20,000	1922	7,120	1,922,477
1882	200	40,000	1923	9,361	2,752,124
1883	198	40,000	1924	9,168	2,401,968
1884	159	32,000	1925	9,894	2,809,929
1885	20	4,000	1926	9,303	2,604,933
1886	15	3,000	1927	7,470	1,957,217
1887	----------	----------	1928	8,187	2,357,894
1888	9	2,000	1929	10,467	3,684,338
1889	9	2,000	1930	10,584	2,751,962
1890	38	11,000	1931	6,687	1,217,016
1891	30	7,000	1932	3,508	441,970
1892	47	11,000	1933	4,319	552,891
1893	320	64,000	1934	6,928	1,108,544
1894	237	47,000	1935	6,864	1,139,457
1895	388	78,000	1936	7,888	1,451,346
1896	583	132,000	1937	7,700	1,863,400
1897	509	122,000	1938	6,082	1,192,123
1898	674	170,000	1939	5,247	1,091,376
1899	552	182,000	1940	6,871	1,552,846
1900	602	202,000	1941	6,359	1,500,606
1901	860	221,450	1942	6,642	1,607,364
1902	4,552	974,988	1943	7,568	1,967,680
1903	6,834	1,667,543	1944	7,636	2,061,720
1904	5,702	1,455,059	1945	6,959	1,878,930
1905	7,270	2,268,549	1946	6,985	2,263,140
1906	8,989	3,470,008	1947	6,825	2,866,500
1907	9,447	3,778,623	1948	6,693	2,904,762
1908	9,730	2,568,654	1949	6,489	2,556,666
1909	9,603	2,496,885	1950	6,851	2,850,016
1910	8,419	2,138,391	1951	7,069	3,421,396
1911	9,425	2,356,285	1952	7,620	3,688,080
1912	9,241	3,049,724	1953	7,829	4,493,846
1913	9,695	3,005,566	1954	9,087	5,361,330
1914	9,369	2,492,108	1955	9,911	7,393,569
1915	9,023	3,158,042	1956	10,449	8,881,650
1916	7,340	3,611,229	1957	9,790	5,893,580
1917	8,016	4,377,213	1958	9,109	4,791,334
1918	7,400	3,655,521	1959	11,490	7,054,860
1919	7,811	2,905,988			
1920	8,364	3,077,916	Total	494,085	170,135,456

Silver.—Tennessee Copper Co. recovered silver as a byproduct from smelting copper and zinc concentrates. Production increased 34 percent but was 45 percent below the record of 1913.

Titanium.—E. I. du Pont de Nemours & Co., Inc., completed the Johnsonville titanium dioxide plant.

Zinc.—Tennessee maintained its position as the leading zinc producing State. Production of recoverable zinc expanded 52 percent over the record of 1958. Table 15 shows zinc production, earliest records to date.

New Jersey Zinc Co. operated the new Flat Gap mine in Hancock County and the Jefferson City mine in Jefferson County. American Zinc Co. of Tennessee operated the North Friends Station, Young, and Coy mines in Jefferson County, and the Mascot No. 2 mine in Knox County. Tennessee Coal & Iron Division of United States Steel Corp. operated the Zinc Mine Works in Jefferson County. Tennessee Copper Co. recovered zinc concentrate from copper-zinc ores mined in Polk County. Total crude ore milled was 3,892,000 tons.

Successful operation of the Flat Gap mine at Treadway opened an entirely new zinc district, 45 miles northeast of the Mascot-Jefferson City district, and southwest of the Austinville, Va. district.

American Zinc Co. of Tennessee announced plans to sink a new shaft to develop the Immel mine. The company announced that the ore reserve on 17,000 acres was more than 100 million tons of ore expected to yield 6 million tons of 60-percent zinc concentrate.

Exploration and development at zinc and copper-zinc mines included: Diamond drilling, 70,843 feet; long-hole drilling, 40,797 feet; drifting, 17,048 feet; churn drilling, 8,696 feet; raising, 4,035 feet; and sinking, 148 feet.

TABLE 14.—Mine production of recoverable gold, silver, copper, lead, and zinc

Year	Gold		Silver		Copper	
	Troy ounces	Value (thousands)	Troy ounces	Value (thousands)	Short tons	Value (thousands)
1950–54 (average)	204	$7	50,436	$46	7,691	$3,963
1955	221	8	66,619	60	9,911	7,394
1956	189	7	64,878	59	10,499	8,882
1957	172	6	54,407	49	9,790	5,893
1958	124	4	44,592	40	9,109	4,791
1959	99	3	59,739	54	11,490	7,055
1850–1959 (total)	23,399	(1)	3,741,439	(1)	494,085	170,135

Year	Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	31	$9	36,155	$10,423	$14,448
1955	------	------	40,216	9,893	17,355
1956	5	1	46,023	12,610	21,559
1957	------	------	58,063	13,471	19,419
1958	------	------	59,130	12,062	16,899
1959	------	------	89,932	20,684	27,796
1850–1959 (total)	27,100	3,176	1,352,338	263,546	440,929

[1] Included with total value.

TABLE 15.—Mine production of recoverable zinc, 1906–1959

Year	Short tons	Value	Year	Short tons	Value
1906	124	$11,400	1934	25,972	$2,233,592
1907	109	12,900	1935	23,102	2,032,976
1908	344	32,343	1936	23,830	2,383,000
1909	596	64,377	1937	29,335	3,813,550
1910	967	104,358	1938	29,810	2,861,760
1911	1,117	127,338	1939	32,375	3,367,000
1912	2,191	302,310	1940	34,796	4,384,296
1913	5,583	625,296	1941	36,170	5,425,500
1914	10,425	1,063,350	1942	43,971	8,178,606
1915	16,461	4,082,440	1943	41,766	9,021,456
1916	26,428	7,082,634	1944	40,831	9,309,468
1917	28,497	5,813,501	1945	33,824	7,779,520
1918	21,071	3,834,859	1946	24,614	6,005,816
1919	23,247	3,394,062	1947	31,212	7,553,304
1920	19,217	3,113,154	1948	29,524	7,853,384
1921	9,692	969,200	1949	29,788	7,387,424
1922	15,568	1,774,752	1950	35,326	10,032,584
1923	15,900	2,162,400	1951	38,639	14,064,596
1924	14,376	1,868,880	1952	38,020	12,622,640
1925	16,256	2,470,912	1953	38,465	8,846,950
1926	12,098	1,814,700	1954	30,326	6,550,345
1927	10,400	1,331,200	1955	40,216	9,893,136
1928	14,597	1,780,834	1956	46,023	12,610,302
1929	19,805	2,614,260	1957	58,063	13,470,616
1930	22,606	2,170,176	1958	59,130	12,062,520
1931	25,320	1,924,320	1959	89,932	20,684,360
1932	12,841	770,460			
1933	21,442	1,801,128	Total	1,352,338	263,546,245

REVIEW BY COUNTIES

Production was reported from 77 counties in the State, compared with 75 in 1958; the leading producers were Knox, Polk, Jefferson, Marion, and Maury Counties. In addition to the commodities listed in table 16, small quantities of oil, gas, and gem stones were produced; county origin was undetermined.

Anderson.—The Dean mine (Windrock Coal & Coke Co.), the Moore mine (Pocahontas Fuel Co.), and the No. 1 strip mine (Tennco, Inc.) were the leading producers of the 63 active coal mines. Ralph Rogers & Co. (Oak Ridge quarry) and Anderson County Highway Department (Taylor No. 1 quarry) crushed limestone for concrete, roads, and stone sand. Lake City Lightweight Aggregate Corp. mined miscellaneous clay for lightweight aggregate.

Bedford.—Shelbyville Limestone Co. and Bedford County Highway Department (Delton Baker quarry) crushed limestone for concrete, roads, and railroad ballast.

Benton.—Eight mines produced sand and gravel for structural, paving, molding, grinding and polishing, glass, and fire or furnace uses. Leading producers were Hardy Sand Co. (Silica and Camden mines) and Camden Gravel Co.

Bledsoe.—Nine coal mines were active; leading producers were the No. 1 mine (Hugh Allison Coal Co.), the No. 3 mine (Dillard Coal Co.), and the No. 1 mine (McDanials Coal Co.).

Blount.—John J. Craig Co. (Hamil, Crisp, Marmor, and Lee quarries), Gray Knox Marble Co. (Brown and French Pink quarries), and Endsley Marble Co. quarried dimension marble for rough and dressed building stone and dressed monumental stone. John J. Craig Co. crushed marble for terrazzo and other uses. Lambert Bros. Division of Vulcan Materials Co. crushed limestone for concrete, roads, and agstone at the Maryville quarry. Big Flag Spring Mining Co. mined brown iron ore at the Wilson mine.

TABLE 16.—Value of mineral production in Tennessee, by counties [1]

County	1958	1959	Minerals produced in 1959 in order of value [2]
Anderson	(3)	(3)	Coal, limestone, miscellaneous clay.
Bedford	(3)	(3)	Limestone.
Benton	$1,033,617	$1,284,016	Sand and gravel.
Bledsoe	133,312	142,271	Coal.
Blount	(3)	(3)	Marble, limestone, iron ore.
Bradley	(3)	(3)	Limestone.
Campbell	3,149,753	2,183,716	Coal, limestone, sandstone.
Cannon	(3)	30,000	Limestone.
Carter	(3)	(3)	Limestone, manganese ore, granite, sandstone.
Claiborne	1,105,165	691,637	Coal.
Cocke	80,076	48,480	Limestone.
Coffee	(3)	(3)	Do.
Cumberland	2,451,973	(3)	Sandstone, limestone, coal, sand and gravel.
Davidson	6,364,960	8,162,786	Cement, limestone, phosphate rock, sand and gravel, lime, miscellaneous clay.
Decatur	189,000	(3)	Limestone, sand and gravel.
De Kalb	26,620	45,348	Limestone.
Dickson	(3)	(3)	Do.
Fayette	76,690	161,600	Limestone, sand and gravel.
Fentress	429,592	(3)	Coal, limestone, sandstone.
Franklin	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Giles	1,370,935	(3)	Phosphate rock, limestone, sand and gravel.
Grainger	39,583	-----------	
Greene	(3)	(3)	Limestone, mica, sand and gravel.

See footnotes at end of table.

TABLE 16.—Value of mineral production in Tennessee, by counties[1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value[2]
Grundy	$541,079	$723,651	Coal, limestone.
Hamblen	(3)	330,559	Limestone.
Hamilton	7,572,873	7,122,063	Cement, limestone, sand and gravel, coal, miscellaneous clay.
Hancock	----------	(3)	Zinc ore.
Hardeman	----------	14,660	Sand and gravel.
Hawkins	(3)	53,550	Limestone, gem stones.
Haywood	90,000	65,000	Sand and gravel.
Henderson	(3)	(3)	Do.
Henry	(3)	(3)	Ball clay, fuller's earth.
Hickman	(3)	(3)	Phosphate rock.
Humphreys	(3)	(3)	Limestone, sand and gravel.
Jefferson	(3)	(3)	Zinc ore, limestone.
Johnson	666,071	(3)	Limestone, manganese ore.
Knox	14,273,157	16,972,602	Cement, zinc ore, marble, limestone, lime, sand and gravel, miscellaneous clay.
Lauderdale	40,000	44,350	Sand and gravel.
Lincoln	(3)	(3)	Limestone.
Loudon	35,434	41,870	Sand and gravel, barite, miscellaneous clay.
Macon	(3)	108,717	Limestone.
Marion	(3)	(3)	Coal, cement, limestone.
Marshall	(3)	(3)	Limestone.
Maury	9,327,547	9,728,406	Phosphate rock, limestone.
McMinn	(3)	(3)	Limestone, barite, iron ore.
McNairy	(3)	(3)	Sand and gravel.
Meigs	(3)	(3)	Limestone.
Monroe	(3)	(3)	Limestone, barite, sand and gravel.
Montgomery	(3)	(3)	Limestone.
Morgan	2,807,526	2,242,035	Coal.
Obion	51,999	103,600	Sand and gravel.
Overton	236,067	276,267	Coal.
Perry	10,000	25,770	Limestone.
Polk	(3)	(3)	Copper, pyrite, zinc ore, silver, gold.
Putnam	1,669,338	2,162,753	Coal, limestone, sand and gravel.
Rhea	729,977	(3)	Coal, limestone, miscellaneous clay.
Roane	(3)	(3)	Limestone.
Robertson	(3)	(3)	Do.
Rutherford	477,245	(3)	Do.
Scott	2,951,486	1,954,209	Coal.
Sequatchie	1,257,399	(3)	Coal, limestone.
Sevier	(3)	179,491	Limestone.
Shelby	1,602,475	1,773,982	Sand and gravel, miscellaneous clay.
Smith	(3)	(3)	Limestone.
Stewart	----------	(3)	Sand and gravel, limestone.
Sullivan	(3)	(3)	Cement, limestone, miscellaneous clay.
Sumner	371,520	(3)	Limestone, sand and gravel.
Tipton	(3)	(3)	Sand and gravel.
Unicoi	(3)	(3)	Sand and gravel, manganese ore.
Union	(3)	(3)	Marble, iron ore.
Van Buren	241,680	223,261	Coal.
Warren	(3)	(3)	Limestone, sand and gravel.
Washington	(3)	(3)	Limestone, miscellaneous clay.
Wayne	(3)	(3)	Sand and gravel.
Weakley	(3)	(3)	Ball clay.
White	540,785	(3)	Limestone, coal.
Williamson	(3)	(3)	Phosphate rock, limestone.
Wilson	(3)	541,994	Limestone.
Undistributed[4]	62,994,066	83,300,356	
Total	124,934,000	140,739,000	

[1] The following counties are not listed because no production was reported: Carroll, Cheatham, Chester, Clay, Crockett, Dyer, Gibson, Hardin, Houston, Jackson, Lake, Lawrence, Lewis, Madison, Moore, Pickett, Trousdale.

[2] Petroleum and natural gas not listed by counties as data are not available; value included with "Undistributed."

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Includes value of petroleum and natural gas and values indicated by footnote 3.

Bradley.—Bradley Limestone Co. Inc., crushed limestone for concrete, roads, and agstone at the Welch quarry.

Campbell.—Sixty-eight coal mines were active; leading producers were the Red Ash auger mine (Price Coal Co.), the Tower strip mine (Cofer Coal Co.), and the No. 1 strip mine (Dixie Pine Coal Co.). Key Limestone (LaFollette quarry), Jellico Stone Co. Inc. (Jellico quarry), and Campbell County Highway Department (Jacksboro quarry) crushed limestone for concrete, roads, and agstone. One producer crushed sandstone for abrasives and cement.

Cannon.—Woodbury Stone Co. crushed limestone for concrete and roads at the Norvell quarry.

Carter.—Watauga Stone Co. crushed limestone for concrete, roads, agstone, and stone sand. Virginia Iron, Coal & Coke Co. (Stoney Creek mine) and Lewis Mining Co. (Casey Hollow mine) mined Metallurgical-grade manganese ore. Blue Ridge Stone Co. crushed granite for concrete and roads at the Greer quarry. Major Sand Co. Inc. crushed sandstone for concrete, roads, and refractory stone.

Claiborne.—Eighteen coal mines were active; leading producers were the No. 1 mine (Sowders Coal Co.), the No. 1 mine (Harris Branch Coal Co.), and the No. 1 mine (New King Mountain Coal Co.).

Cocke.—Cocke County Highway Department crushed limestone for concrete and roads at the Smith quarry.

Coffee.—Ralph Rogers & Co. (Coffee quarry) crushed limestone for concrete, roads, and railroad ballast.

Cumberland.—Eleven companies quarried dimension sandstone for rough architectural, sawed and dressed building stone, and flagging. The leading producers were Tennessee Stone Co. Inc. (McGuire quarry), Crab Orchard Stone Co. Inc. (Peck quarry), and Turner Bros. Stone Co. Inc. Sandstone crushed for refractory stone was produced by Turner Bros. Stone Co. Inc. Southern States Lime Mfg. Co. (Crab Orchard mine) and Cumberland County Road Commission (County quarry) crushed limestone for glass, concrete, roads, paper, fertilizer, filler, rock dust for coal mines, mineral food, and other uses. Twenty-three coal mines were active; leading producers were the No. 1 strip mine (Waters Coal Co.), the No. 1 strip mine (E. C. McPherson), and the No. 1 mine (I. E. Brown). Potter Sand & Gravel Co. mined structural, paving, and fill sand and gravel.

Davidson.—Marquette Cement Mfg. Co. produced masonry and portland cements at its Nashville mill throughout the year. Seven quarries produced limestone for riprap, concrete, roads, stone sand, agstone, asphalt filler, and other uses; the leading producers were Lambert Bros. Division of Vulcan Materials Co. (Hermitage, Danley, and Old Hickory quarries) and McMinnville Rock Co. Inc. Monsanto Chemical Co. and Harsh Phosphate Co. mined marketable phosphate rock. Cumberland River Sand & Gravel Co. mined structural, paving, and fill sand and gravel.

Victor Chemical Works produced lime for industrial uses. W. G. Bush & Co. Inc. (Nashville mine) mined miscellaneous clay for heavy clay products. Tennessee Products & Chemical Corp. (Nashville plant) expanded crude perlite from Western States. Zonolite Co. exfoliated crude vermiculite from South Carolina and Montana at the Nashville mill.

Decatur.—Western Materials, Inc. (Parsons quarry) crushed limestone for concrete, roads, and agstone. Tinker Sand & Gravel Co. (Perryville mine) mined structural and paving sand and gravel.

De Kalb.—De Kalb County Highway Department crushed limestone for concrete and roads at the Chapman Hollow quarry.

Dickson.—Duke Lime & Stone Co. (Duke mine) crushed limestone for concrete, roads, agstone, and stone sand.

Fayette.—Fayette County Highway Department crushed limestone for concrete and roads and also mined paving gravel.

Fentress.—Twenty-six coal mines were active; leading producers were the Sandy mine (J. L. Johnson Coal Co.), the Wilder mine (Lane Coal Co.), and the Muddy Pond strip mine (Dixie Mining Co.). Frogge & Williams, Inc. (Wright quarry) crushed limestone for concrete, roads, and agstone. Kentucky-Tennessee Stone Co. (Jamestown quarry) quarried dimension sandstone for rough architectural use.

Franklin.—Marquette Cement Mfg. Co. produced masonry and portland cements at the Cowan mill throughout the year. Marquette Cement Mfg. Co., Cowan Stone Co. (Cowan quarry and Anderson mine), and Franklin County Highway Department (Bostick quarry) crushed limestone for fluxing stone, concrete, roads, railroad ballast, agstone, glass, cement, and other uses. Estill Springs Sand-Gravel Co. mined structural and paving sand and gravel. Marquette Cement Mfg. Co. mined miscellaneous clay for use in cement.

Giles.—Monsanto Chemical Co. and International Minerals & Chemical Corp. (Wales mine) mined marketable phosphate rock for use in agriculture, pig-iron blast furnaces, and elemental phosphorus. Cedar Grove Lime Co. crushed limestone for concrete, roads, and agstone. Giles County Highway Department mined paving gravel.

Greene.—Malone Bros. Co., Agricultural Lime Co. Inc. (Greenville quarry), and Greene County Highway Department (Ratcliffe quarry) crushed limestone for concrete, roads, and agstone. International Minerals & Chemical Corp. recovered scrap mica from silt deposits in Davy Crockett Lake. Nolichuckey Sand Co. (Bewley mine) mined structural and paving sand and gravel.

Grundy.—Seven coal mines were active; leading producers were the No. 1 strip mine (Ramsey Coal Co.), the Commando strip mine (Phipps Coal Co.), and the No. 1 mine (Charley Martin Coal Co.). Viola White Lime Co. crushed limestone for concrete, roads, and agstone at the Old State quarry.

Hamblen.—White Pine Stone Co. crushed limestone for concrete and roads at the Hamblen quarry.

Hamilton.—Signal Mountain Portland Cement Division of General Portland Cement Co. produced masonry and portland cements at the Signal Mountain mill throughout the year. Chattanooga Rock Products Division of Vulcan Materials Co. crushed limestone for concrete, roads, railroad ballast, and agstone at the Chattanooga quarry. Dixie Sand & Gravel Co. mined structural and paving sand and gravel. Fourteen coal mines were active; leading producers were the No. 2 mine (Hickey & Teeters Coal Co.), the Russco strip mine (Russco, Inc.), and the No. 1 mine (Dave Frizzell Coal Co.). B. Mifflin-Hood Co. mined miscellaneous clay for floor and wall tile at the Daisy mine.

Hancock.—New Jersey Zinc Co. recovered zinc from zinc ores mined at the new Flat Gap mine.

Hardeman.—Tri-State Sand Co. mined structural sand.

Hawkins.—Lambert Bros. Division of Vulcan Materials Co. crushed limestone for concrete and roads at the McCloud quarry. Willard Pratt collected a small quantity of gem stones (barite crystals).

Haywood.—Haywood County Highway Department mined paving gravel.

Henderson.—Ayers Mineral Co. mined molding sand at the Zane mine.

Henry.—Kentucky-Tennessee Clay Co. (Tennessee mine), H. C. Spinks Co. (Henry mine), and Dixie Brick & Tile Co. (Puryear mine) mined ball clay for whiteware; floor and wall tile; firebrick and block; saggers, pins, stilts, and wads; heavy clay products; and for export. Southern Clay Co. Inc. (Porters Creek mine) and Tennessee Absorbent Clay Co. (Paris mine) mined fuller's earth for absorbent uses.

Hickman.—M. C. Boyle Phosphate Co. mined marketable phosphate rock at the Bratton mine for agriculture.

Humphreys.—Lambert Bros. crushed limestone for concrete, roads, and agstone at the Rock Hill quarry. Sangravl Co. Inc. mined structural sand and gravel.

Jefferson.—Jefferson County ranked third in the State in total value of mineral production. New Jersey Zinc Co. (Jefferson City mine), American Zinc Co. of Tennessee (North Friends Station, Young, and Coy mines), and Tennessee Coal & Iron Division of United States Steel Corp. (Zinc Mine Works) recovered zinc from zinc ores. Limestone was produced as a byproduct from zinc mines; this material was used for concrete, roads, railroad ballast, agstone, and stone sand.

Johnson.—Seven mines produced Metallurgical-grade manganese ore for sale to the Government. Leading producers were B & T Mining Co. (Davis mine) and Valley Mining Co., Ltd. (Barry Blevins and Blackburn mines). Maymead Lime Co. crushed limestone for concrete, roads, and agstone.

Knox.—Knox County led the State in total value of mineral production. Volunteer Portland Cement Co. produced masonry and portland cements at the Knoxville mill throughout the year. American Zinc Co. of Tennessee (Mascot No. 2 mine) mined zinc ore and recovered limestone as a byproduct. Tennessee Marble Co. (Eagle quarry), Gray Knox Marble Co. (Gray Knox quarry), and Appalachian Marble Co. (Bond and Appalachian quarries) produced dimension marble for rough and dressed building stone and for cut, dressed monumental stone. Appalachian Marble Co. and Knoxville Crushed Stone Co. crushed marble for terrazzo and other uses.

Ten quarries and one mine produced crushed limestone for concrete, roads, railroad ballast, cement, lime, and other uses. Leading producers were Volunteer Portland Cement Co. (Knoxville quarry) and Lambert Bros. (City, Neuberts, Freeway, Biagotti, and Kennedy quarries). Standard Lime & Stone Co., Division of American-Marietta Co., and Williams Lime Mfg. Co. produced lime for building, agricultural, chemical, and industrial uses. Knoxville Sand & Gravel Co., Oliver King Sand-Lime Co., and Cameron Sand & Gravel Co. mined structural, paving, grinding and polishing, and engine sands; structural and paving gravel. Four mines produced miscellaneous clay for cement, lightweight aggregate, and heavy clay products; Shalite Corp. was the leading producer.

Lauderdale.—Lauderdale County Highway Department mined paving gravel.

Lincoln.—Clark & Stephenson crushed limestone for concrete and roads at the Fayetteville quarry.

Loudon.—Brooks Sand & Gravel Division of Vulcan Materials Co. mined structural and paving sand. Smith Mines, Inc., mined barite. Old Hickory Brick Co. (Greenback mine) mined miscellaneous clay for heavy clay products.

Macon.—Dixon & Stubblefield crushed limestone for concrete, road, and agstone at the Langford quarry.

Marion.—Marion County ranked fourth in the State in total value of mineral production. Ninety-two coal mines were active; leading producers were the Coal Valley mine (Tennessee Consolidated Coal Co.), Reels Cove mine (Tennessee Products & Chemical Corp.), and Whitco strip mine (Whitwell Coal Corp.). Penn-Dixie Cement Corp. produced portland cement at the Richard City mill. Signal Mountain Portland Cement (Bennetts Lake quarry), Penn-Dixie Cement Corp., and Chattanooga Rock Products Division of Vulcan Materials Co. (Ketchall quarry) crushed limestone for concrete, roads, cement, and agstone.

Marshall.—Lewisburgh Limestone Co. crushed limestone for concrete, roads, and agstone.

Maury.—Maury County ranked fifth in the State in total value of mineral production. Six mines produced marketable phosphate rock; leading producers were Monsanto Chemical Co., Victor Chemical Works, and Presnell Phosphate Co., Inc. Columbia Rock Products Corp. crushed limestone for concrete, roads, agstone, and stone sand at the Theta Pike mine.

McMinn.—Floyd D. Webb Stone Co. and McMinn County Highway Department crushed limestone for concrete and roads. McMinn Barium Corp. (Athens mine) and National Lead Co. (Ballard mine) mined barite. Rucker Mining Co. mined brown iron ore at the Nonaburg mine.

McNairy.—Worsham Bros. mined structural, paving, fill, railroad ballast, and miscellaneous sand and gravel.

Meigs.—Ten Mile Stone Co. and Meigs Stone Co. (Posey quarry) produced limestone for riprap, concrete, roads, agstone, asphalt filler, and filter beds.

Monroe.—Creighead Limestone Co. crushed limestone for concrete and roads. National Lead Co. mined barite at the Jones and Roy mines. Vonore Sand Co. mined structural sand.

Montgomery.—Simpson Stone Co. (Simpson quarry) and Clarksville Stone Co. (Clarksville mine) crushed limestone for concrete, roads, and agstone.

Morgan.—Forty-one coal mines were active; leading producers were the No. 6 strip mine (Allen Bros. Coal Co.), the No. 7 mine (Brushy Mountain Coal Mines), and the No. 2 auger mine (Tennessee Auger Co.).

Obion.—Obion County Highway Department mined paving gravel at the county mine.

Overton.—Twenty coal mines were active; leading producers were the No. 1 mine (Lindsay & Howell Coal Co.), the No. 1 mine (Brown Coal Co.), and the Baker No. 2 mine (Key Coal Co., Inc.).

Perry.—Perry County Stone Co. (Elkins quarry) crushed limestone for concrete, roads, and agstone.

Polk.—Polk County ranked second in the State in value of mineral production. Tennessee Copper Co. produced mixed sulfide ore at the Boyd, Calloway, Eureka, and Mary mines. The ore, concentrated in one flotation mill, yielded copper, iron (pyrite), and zinc concentrates; gold and silver were recovered as byproducts from smelting the copper and zinc concentrates; the iron concentrate was roasted, yielding sulfur dioxide, for use mainly in manufacturing sulfuric acid, and iron oxide, which was sintered for use by iron and steel plants. The company began sinking the Cherokee shaft.

Putnam.—Algood Limestone Co. (Poteet quarry) and Putnam County Highway Department produced limestone for concrete, roads, riprap, and agstone. The Meadow Creek mine (Clinchfield Coal Co.) was the only active coal mine. Sand, Inc., mined structural, paving, and fill sand.

Rhea.—Ten coal mines were active; leading producers were the Kirkwood No. 1 mine (Rhea Fuel Co.), the No. 1 mine (Erwin & Sons), and the Bumbee mine (Norris Coal Co.). Rhea County Limestone Co. (Dayton quarry) crushed limestone for concrete, roads, and agstone. W. S. Dickey Clay Mfg. Co. (Graysville Clay mine) mined miscellaneous clay for heavy clay products.

Roane.—A. B. Long Construction Co. (Swan Pond quarry) and Lambert Bros. (Rockwood quarry) produced limestone for riprap, concrete, roads, agstone, stone sand, and other uses.

Robertson.—Porter Brown Limestone Co. crushed limestone for concrete and roads.

Rutherford.—A & R Stone Co. Inc. and Bilbrey Rock Co. crushed limestone for concrete, roads, and agstone.

Scott.—Thirty-two coal mines were active; leading producers were the Lassie No. 1 mine (Laddie Coal & Mining Co.), the No. 6 strip mine (H & W Coal Co.), and the Dean No. 2 auger mine (Dean Coal Co.)

Sequatchie.—Forty-one coal mines were active; leading producers were the D–204 mine (Clifford Cordell), the D–202 mine (Bluff Coal Co.), and the Woodcock mine (Earl Patton Coal Co.). Dunlap Stone Co. (Sequatchie quarry) crushed limestone for concrete, roads, and agstone.

Sevier.—Lambert Bros. (Sevier quarry) and H. R. Fipps & Son, Inc., crushed limestone for concrete and roads. H. R. Fipps & Son, Inc., also quarried dimension limestone for rubble.

Shelby.—Eight mines produced structural, paving, and fill sand and gravel. Leading producers were Memphis Stone & Gravel Co. (Raleigh and York mines), Marquette Cement Mfg. Co. (Tennessee mine), and Bluff City Sand & Gravel Co. Inc. (Memphis mine). Moss Lightweight Aggregate Co. (Clay mine) and John A. Denie's Sons Co. (Memphis mine) mined miscellaneous clay for lightweight aggregate and heavy clay products.

Smith.—Oldham Limestone Co. crushed limestone for concrete, roads, and agstone at the Rome quarry.

Stewart.—Sangravl Co. Inc., mined structural and paving sand and gravel. Oolite Minerals Corp. Inc., crushed limestone for agstone.

Sullivan.—Penn-Dixie Cement Corp. produced masonry and portland cements at the Kingsport mill throughout the year. Lambert Bros. crushed limestone for concrete, roads, and agstone. General Shale Products Corp. and Penn-Dixie Cement Corp. mined miscellaneous clay for cement and heavy clay products.

Sumner.—Ralph Rogers & Co. and Pilot Knob Limestone Co. crushed limestone for concrete, roads, agstone, and stone sand. Sumner County Highway Department mined paving gravel.

Tipton.—Clyde Owen Sand & Gravel Co. mined structural and paving sand and gravel at the Covington mine.

Unicoi.—Brooks Sand & Gravel Division of Vulcan Materials Co. mined structural and paving sand, and structural, paving, and railroad ballast gravel. Manganese ore was mined at the Bumpass Cove mine by Turner Mines and United States Manganese Sulfate Corp. The Feldspar Corp. ground feldspar at the Erwin plant.

Union.—Tennessee Marble Co. quarried dimension marble for rough and dressed building stone and dressed monumental stone at the Luttrell quarry. Walt Mining Co. mined red iron ore at the Riddle mine.

Van Buren.—Thirteen coal mines were active; leading producers were the No. 1 mine (I. E. Brown Coal Co.), the D & H strip mine (D & H Coal Co.), and the Buckridge mine (Buckridge Coal Co.).

Warren.—Warren Limestone Co. (McMinnville mine) crushed limestone for concrete, roads, and agstone. Cumberland Mountain Sand Co. mined structural, paving, and fill sand.

Washington.—Washington County Highway Commission crushed limestone for concrete and roads. General Shale Products Corp. mined miscellaneous clay for heavy clay products.

Wayne.—Hassell & Dowdy Sand & Gravel Co. (Baker mine) and Wayne County Highway Department mined structural and paving sand and gravel.

Weakley.—United Clay Mines Corp. (No. 6 mine), Bell Clay Co. (Collins mine), H. C. Spinks Clay Co. (Gleason mine), and Cooley Clay Co. (Greenfield mine) mined ball clay for whiteware, art pottery, high-grade tile, kiln furniture, rubber filler, pastes, and enameling.

White.—Sparta Limestone Co. (Sparta quarry), Thompson-Weinman & Co. (Sparta mine), and White County Highway Department (W. L. Carter quarry) crushed limestone for concrete, roads, agstone, and whiting. The No. 5 mine (Smith & Welch Coal Co.) and the No. 1 mine (Elbert Brown Coal Co.) were the only active coal mines.

Williamson.—Monsanto Chemical Co. mined marketable phosphate rock for elemental phosphorus. Lambert Bros. Division of Vulcan Materials Co. (Franklin quarry) and Williamson County Highway Department (Globe quarry) crushed limestone for concrete, roads, and agstone.

Wilson.—Marquette Cement Mfg. Co. (Martha quarry), Lebanon Limestone Co., and Wilson County Rock Products, Inc., crushed limestone for concrete, roads, agstone and cement.

The Mineral Industry of Texas

This chapter has been prepared under the cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and The University of Texas, Bureau of Economic Geology.

By F. F. Netzeband [1] and Roselle M. Girard [2]

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TEXAS produced an imposing $4.2 billion worth of minerals in 1959 and led the Nation for the 25th consecutive year. For the 17th successive year, the value of its mineral production exceeded $1 billion. The State was the largest producer of crude oil, natural gas, natural-gas liquids, helium, sulfur, and magnesium. Important quantities of cement, clay, gypsum, iron ore, lime, salt, sand and gravel, and stone also were produced. Minerals and mineral fuels came from 233 of the State's 254 counties in 1959; crude oil from 196; natural gas, 151; natural-gas liquids, 91; nonmetals, 154; and metals from 6 counties.

TABLE 1.—Mineral production in Texas [1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Cement……thousand 376-pound barrels	25, 875	$79, 756	27, 991	$88, 067
Clays [2]	3, 720	5, 424	3, 870	5, 703
Gem stones	(3)	100	(3)	100
Gypsum	1, 240	4, 120	1, 351	4, 770
Helium……thousand cubic feet	294, 452	4, 807	238, 113	3, 918
Lime	691	7, 146	809	8, 530
Natural gas……million cubic feet	5, 178, 073	517, 807	[4] 5, 600, 300	[4] 560, 400
Natural-gas liquids:				
Natural gasoline and cycle products……thousand gallons	2, 871, 589	204, 501	2, 790, 155	209, 238
LP-gases……do	3, 786, 575	151, 896	4, 353, 368	181, 148
Petroleum (crude)……thousand 42-gallon barrels	940, 166	2, 872, 389	[4] 983, 840	[4] 2, 931, 843
Salt (common)	3, 843	15, 115	4, 519	17, 498
Sand and gravel	32, 871	30, 808	35, 295	34, 726
Stone	36, 076	40, 912	42, 172	47, 787
Sulfur (Frasch-process)……thousand long tons	2, 616	61, 621	2, 970	68, 998
Talc and soapstone……short tons	60, 827	168	60, 945	283
Value of items that cannot be disclosed: Abrasive stones, asphalt native, bromine, clay (fuller's earth), coal (lignite), feldspar, graphite, iron ore (usable), magnesium chloride (for metal), magnesium compounds (except for metal), mercury, pumice, sodium sulfate, and uranium ore	----------	[5] 46, 891	----------	48, 544
Total Texas [6]	----------	[5] 4, 033, 311	----------	4, 201, 203

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2] Excludes certain clays, value for which is included with "Items that cannot be disclosed".
[3] Weight not recorded.
[4] Preliminary figures.
[5] Revised figure.
[6] Total has been adjusted to eliminate duplicating the value of clays and stone.

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Important and varied metal-extracting industries in Texas comprised 18 installations: 2 alumina plants; 3 aluminum, 1 magnesium, 1 manganese, and 1 mercury reduction works; 1 antimony, 1 copper, 1 lead, 1 tin, and 3 zinc smelters; 1 copper refinery; and 2 iron blast furnaces. Cadmium was recovered as a byproduct of smelter dust collection, and zinc was recovered at a fuming plant.

Economic factors that stimulated the mineral industries to near-record production in 1959 were: Larger plant and equipment expenditures, a shift from liquidation to accumulation of inventories, rising purchases of durable consumer goods, and more Government purchases and services. Many of the basic oil, metal, and nonmetal industries in Texas continued to diversify their activities during the year to maintain established markets or to develop new ones. New markets and new products were developed by the important chemical and petrochemical industries, which consumed large quantities of solid inorganic materials, natural gas, natural-gas liquids, and intermediates from mineral fuels. The metals industries developed metals of high purity, high fusion temperatures, and exceptional strength for nuclear and missile markets. Domestic and industrial water supplies continued to be a pressing problem in some areas of the State. A comprehensive water program for the entire State was being developed by the U.S. Study Commission for Texas. Two demonstration plants to convert salt and brackish water to fresh water were to be built under authorization of the 85th Congress, one on the Gulf coast and one on the High Plains.

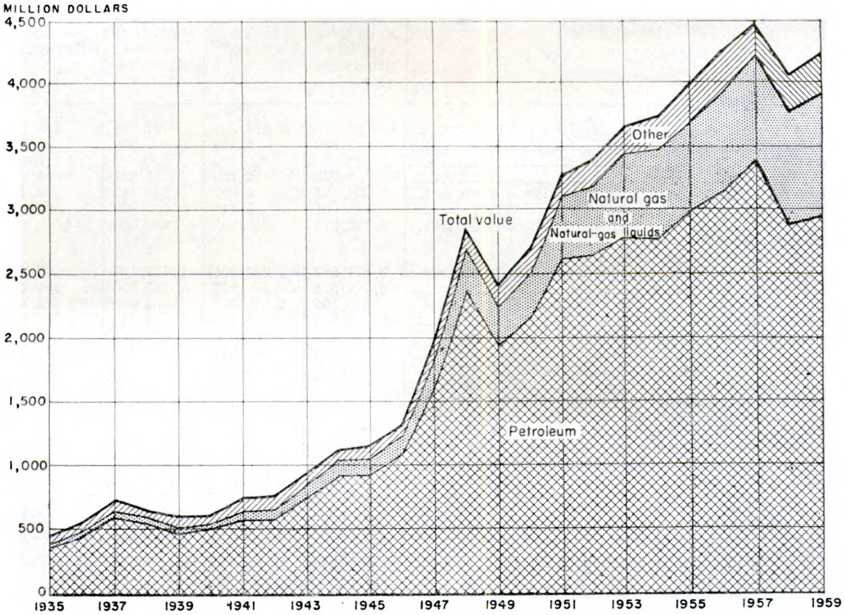

FIGURE 1.—Value of petroleum, natural gas, and natural-gas liquids and total value of mineral production in Texas, 1935–59.

Employment and Injuries.—Employment statistics compiled by the Texas Employment Commission, in cooperation with the Federal Bureau of Labor Statistics, are reported in table 2.

Industrial injuries were analyzed by the Industrial Accident Board of the State of Texas to assist the mineral producers in discovering the factors that are responsible for most injuries. There were 34 fatalities reported by the mineral industry in 1959, 30 by the petroleum and natural-gas industry, and 4 by rock and sand and gravel quarries. Of 3,330 nonfatal injuries, 3 were in metal mining, 3,229 in crude petroleum and natural gas, and 98 in rock and sand and gravel quarrying. Agency factors involved in the 34 fatalities of the mineral industries included: machines 1, elevators and conveyors 4, vehicles 4, chemicals and dust 3, work surfaces 2, other agencies 15, and unclassified 5. Equipment or materials involved in nonfatal injuries included: machines 63, elevators and conveyors 1,269, vehicles 142, hand tools 264, chemicals and dust 119, work surfaces 371, ladders 19, containers 79, trees, logs, and lumber 78, other agencies 834, and unclassified 65.

TABLE 2.—Average employment, weekly hours worked, and weekly earnings in selected industries [1]

Industry	Employment		Weekly hours worked		Weekly earnings	
	1958	1959	1958	1959	1958	1959
Manufacturing	460,400	487,200	40.8	41.6	$85.07	$89.02
Primary metals	22,000	23,900	39.2	40.9	98.14	101.84
Chemicals	48,000	42,400	42.4	41.3	104.57	119.36
Petroleum and coal products	48,200	43,300	40.2	40.4	113.07	119.99
Machinery (oil field)	42,400	39,200	39.8	44.0	92.49	106.92
Transportation equipment	60,300	59,800	39.7	39.9	101.86	99.75
Nonmanufacturing	1,997,000	1,989,100	--------	--------	--------	--------
Mining	125,000	129,400	42.9	43.1	107.42	109.04
Crude petroleum	117,300	122,000	42.8	43.0	109.22	110.51
Sulfur	7,700	7,400	40.2	40.1	101.10	112.28
Construction	159,967	168,500	--------	--------	--------	--------

[1] Texas Employment Commission, in cooperation with U.S. Bureau of Labor Statistics.

One iron ore operator and 8 sand and gravel and stone companies operating 12 plants were recognized for outstanding safety records entailing 977,406 man-hours of operation without a lost-time injury. These safety conscious operators, their plants, and total man-hours without injury were: Lone Star Steel, Lone Star plant, Morris County, 330,007 man-hours; Southwest Construction Materials Co., Fred, John, and Keller plants all in Dallas County, 267,594 man-hours; Central Texas Gravel Co., Burt plant, McLennan County, 98,222 man-hours; Wesco Materials Corp., West plant, Dallas County, 67,648 man-hours; H. B. Zachry Co., Zachry Gravel plant, Bexar County, 46,582 man-hours; Grand Prairie Construction Co., Pete plant, Morris County, 44,525 man-hours; Jefferies and Betts Gravel Co., Inc., Belknap plant, Tarrant County, 36,249 man-hours; Fort Worth Sand and Gravel Co., Hovenkamp and Gulf plants, Tarrant County, 70,021 man-hours; and Southwest Stone Co., No. 4 quarry, Uvalde County, 16,558 man-hours.

Consumption, Trade and Markets.—Because of the size of the mineral industry in Texas, many industries depended upon national and foreign markets rather than intrastate markets. One of the major problems of the Texas economy was the relatively slow development of consumer-oriented industries within the State. For example, in 1958, value of minerals produced was $4 billion, whereas value added by manufacturing was only $5 billion, according to the Bureau of the Census. Among the major industries dependent upon national markets were petroleum refining, natural-gas-liquids extraction, natural-gas distribution, nonferrous and light-metal extractive industries, and bromine, graphite, natural salts, and sulfur.

Several integrated industries converted raw materials into intermediates or finished products for both State and national markets or processed raw materials from other states into intermediates for additional manufacturing outside the State. Among such industries were oil refineries, processing Texas and foreign crude oils; cement plants, using local limestone, shell, and clay; brick, tile, and pottery plants using local clays; and manufacturers of wallboard, sheath, and plaster from Texas gypsum. The rapidly growing petrochemical industry of the Gulf coast produced a wide variety of synthetic resins, plastics, and rubbers from petroleum bases.

Legislation and Government Programs.—Two tax increases affecting the mineral industries were passed by the 56th legislature of Texas. Increases were approved in the cement-production tax and in the franchise tax on corporations doing business in the State. Domestic mineral policies were considered by several Congressional committees of the 86th Congress. These committees studied import quotas on oil and metals, impact of competition from foreign products on domestic firms, U.S. investments abroad, and taxes on domestic firms doing business abroad. The Federal Bureau of Mines planned research programs on bauxite and aluminum, magnesium, titanium, several of the rare-earth minerals, and other alloying minerals.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Texas remained the ranking producer of crude oil, natural gas, natural-gas liquids, and helium in the Nation. Petroleum production improved somewhat over the low production of 1958; the extent of recovery was limited because of excess stocks of many refined products. Daily crude oil production, 2,695,500 barrels, was 4.6 percent higher than production in 1958 but 11 percent below the record 1956 output. Maximum allowed crude oil production was maintained for 123 days compared with 122 days in 1958. Growing stocks of both crude and refined products and a high level of imports lowered the prices of crude oil and refined products. The imbalance of supply and demand of refined products resulted in many price wars at the retail level.

Carbon Black.—Carbon black was recovered from sour natural gas and natural-gas liquids at 22 plants in 15 counties. There were 9 channel plants, 12 furnace plants, and 1 combination channel-furnace plant. The plants consumed 136,699 million cubic feet of gas in producing 331 million pounds of carbon black with an average yield of 2.42 pounds per 1,000 cubic feet of gas, and 168 million gallons of hydrocarbon liquids in producing 692 million pounds of carbon black with an average yield of 4.13 pounds per 1,000 gallons of liquid. A carbon-black plant having a capacity of 60 million pounds was being built by Phillips Chemical Co. at Orange. Initial production was scheduled for the latter half of 1960.

Helium.—Texas remained the Nation's chief supplier of helium with 66 percent of total production. Compared with 1958, production increased 12 percent, shipments decreased 19 percent, and helium stored underground for future use increased 238 percent. Production from a new plant at Keyes, Okla., accounted for most of the changes.

Lignite.—Lignite was produced in two counties by two producers; output was somewhat greater than in 1958. Most of the lignite was used as a fuel for generation of electric power; large quantities were processed for activated carbons.

Natural Gas.—Texas continued to be the ranking natural-gas-producing State with a record ouput of 5,600,300 million cubic feet, up 8 percent from 1958, the previous record year. Of the 1959 output, 2,304,739 million cubic feet was consumed in the State, 2,922,424 million cubic feet exported, and 136,699 million cubic feet used in manufacturing carbon black. Principal gas-producing counties were Panola, Nueces, Brazoria, Hidalgo, and Jim Wells. Natural-gas reserves improved 4.7 percent to 120,475,783 million cubic feet, comprising 45.9 percent of total domestic reserves, according to the American Gas Association. Exploratory drilling added 2,887,699 million cubic feet to the proved gas reserve, and development drilling added 8,228,792 million cubic feet. Ratio of natural-gas reserve to consumption was 21:1; in 1958 it was 19:1. There were 16,752 gas wells producing on December 31, 1959.

TABLE 3.—Marketed production of natural gas [1]

Year	Million cubic feet	Value (thousands)	Year	Million cubic feet	Value (thousands)
1950–54 (average)	3,997,947	$265,652	1957	5,156,215	500,153
1955	4,730,798	378,464	1958	5,178,073	517,807
1956	4,990,889	434,990	1959 [2]	5,600,300	560,400

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

[2] Preliminary figures.

Mobil Oil Co. began pushbutton operation of gas wells 25 miles offshore. Two microwave towers, one at the Cameron (La.) gas-distillate-recovery plant, the other on the offshore platform, relayed operating instructions from shore to platform equipment to control about 5 million cubic feet a day of gas moving from the platform through a 10-inch underwater pipeline to the Cameron facilities. A $12 million gas-gathering system requiring 290 miles of pipeline to gas wells in seven south Texas counties (Brooks, Duval, Hidalgo, Jim Hogg, Starr, Webb, and Zapata) was built to connect with the trunk systems of Transcontinental Gas Pipeline Corp. and Texas Illinois Natural Gas Pipeline Co. Capital Gas Pipeline Co. began constructing a $10 million gas-gathering and transmission system to include 300 miles of feeder and gathering lines in a 9-county region around Breckenridge and a 140-mile trunkline from west central Texas to Austin.

TABLE 4.—Production of natural-gas liquids

(Million gallons and thousand dollars)

Year	Natural gasoline and cycle products		LP-gases		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1950–54 (average)	2, 571	$187, 259	2, 385	$83, 178	4, 956	$270, 437
1955	2, 988	206, 506	3, 450	110, 414	6, 438	316, 920
1956	2, 965	216, 378	3, 731	144, 745	6, 696	361, 123
1957	2, 944	201, 423	3, 832	147, 618	6, 776	349, 041
1958	2, 872	204, 501	3, 786	151, 896	6, 658	356, 397
1959	2, 790	209, 238	4, 354	181, 148	7, 144	390, 386

Natural-Gas Liquids.—Texas was the principal producer of natural-gas liquids, supplying 53 percent of the domestic output. Natural-gasoline plants processed an average of 11,436.5 million cubic feet of gas daily to recover an average of 18,946,255 gallons of liquids. Gas-cycling plants processed 2,202.4 million cubic feet daily and recovered 3,049,724 gallons of liquids. Output in 1959 was 7.3 percent greater than output in 1958; LP-gases accounted for 61 percent of the recovered liquids and natural gasoline and other cycle products for the remaining 39 percent. There were 218 gasoline plants and 27 cycling plants operating in the State. The proved recoverable reserve of natural-gas liquids amounted to 3.5 billion barrels according to the Committee on Natural Gas Reserves of the American Gas Association. The reserve represented 53 percent of the total domestic natural-gasoline reserves and was 1 percent greater than the proved reserve in 1958. Exploratory drilling added 57 million barrels to the proved reserve, and development drilling added 184.5 million barrels.

Small gasoline plants capable of processing 1 to 100 million cubic feet of gas a day and recover 10 to 500 barrels of liquid products daily were being installed in greater numbers on the Gulf coast. These short-cycle absorption units could process gas that was too lean for conventional units. A new short-cycle process, which eliminated objectionable variations in the catalytic conversion of butane and butylene to butadiene, was announced by Dow Chemical Co. Texas Eastern Transmission Corp. was developing the largest existing underground reservoir for LP-gas storage in the Barbers Hill salt dome near Houston—twin cavern reservoirs to hold 21 million gallons of LP-gases. A 10-mile, 12-inch pipeline was being built from the storage site to the company's Baytown pumping station on the "Little Inch" line serving Eastern markets. Shell Oil Co. was building 42,000 feet of gathering lines from wells in the Big Foot field in Frio and Atascosa Counties to connect with a new dehydrating facility, which would recover 100 barrels of natural-gas liquids a day. Shell Oil Co. also was building another gas-processing plant to recover liquid hydrocarbons from casinghead and gas-well gas in the North Rincon field in Starr County. Bay Petroleum Co. built a 50-million-cubic-foot-a-day gas-processing plant to recover 42,000 gallons of gas liquids daily at Copano Bay. The Carancahua Plant of Sunray Mid-Continent Oil Co., completed at midyear, was a highly automatic gas-processing plant capable of processing 40 million cubic feet of gas a day to recover about 12,000 gallons of propane, 4,000 gallons of butane, 5,000 gallons of iso-butane, and 6,000 gallons of natural gasoline. The company also completed a $600,000 automatic gas-processing plant at Port Lavaca capable of processing 30 million cubic feet of gas daily to recover 27,000 gallons of composite liquids using a combination refrigeration-oil absorption technique. Continental Oil Co. built a new $430,000 portable gas-processing plant near Pecos capable of treating 5 million cubic feet of gas a day.

TABLE 5.—Production of crude petroleum

(Thousand barrels and thousand dollars)

Year	Quantity	Value at wells	Year	Quantity	Value at wells
1950–54 (average)	971,144	$2,589,240	1957	1,073,867	$3,338,119
1955	1,053,297	2,989,330	1958	940,166	2,872,389
1956	1,107,808	3,131,225	1959 [1]	983,840	2,931,843

[1] Preliminary figures.

TABLE 6.—Production and indicated demand of crude petroleum in 1959 by months

(Thousand barrels)

Month	Production	Indicated demand	Month	Production	Indicated demand
January	90,300	92,397	September	75,516	74,223
February	80,764	80,405	October	78,366	76,460
March	89,443	91,949	November	76,801	76,699
April	85,118	85,297	December	83,444	82,930
May	88,903	87,027			
June	81,166	79,820	Total:		
July	77,118	77,727	1959	983,840	990,136
August	76,901	85,202	1958	940,166	948,626

TABLE 7.—Prospecting and drilling in 1959 by counties[1]

County	Geophysical prospecting					Drilling						Total
	Seismic	Gravity	Magnetic	Core drill	Total	Development			Exploratory			
						Oil	Gas	Dry	Oil	Gas	Dry	
Anderson	67	------	------	2	69	21	16	30	1	------	45	113
Andrews	52	15	1	------	68	679	1	34	14	1	16	745
Angelina	4	------	------	------	4	------	------	1	------	------	2	3
Aransas	25	7	------	------	32	1	1	1	3	------	7	13
Archer	39	------	------	------	39	96	------	54	20	------	17	187
Armstrong	38	4	------	------	42	------	------	------	------	------	1	1
Atascosa	23	------	------	------	23	10	10	6	------	1	32	59
Austin	22	------	------	------	22	6	2	------	------	1	3	12
Bailey	7	------	------	------	7	------	------	------	------	------	2	2
Bandera	------	------	------	------	------	------	------	------	------	------	------	------
Bastrop	15	1	21	------	37	------	------	2	1	------	14	17
Baylor	10	------	------	------	10	11	------	13	4	------	7	35
Bee	69	------	------	------	69	3	18	18	4	8	43	94
Bell	1	------	------	------	1	------	------	------	------	------	3	3
Bexar	5	------	------	------	5	24	------	14	------	------	13	51
Blanco	------	------	------	------	------	------	------	------	------	------	------	------
Borden	44	1	1	------	46	76	------	13	6	------	24	119
Bosque	1	------	------	2	3	------	------	------	------	------	2	2
Bowie	15	------	------	------	15	------	------	------	------	------	5	5
Brazoria	137	------	------	------	137	31	9	27	------	4	27	98
Brazos	19	10	------	------	29	------	2	------	------	------	1	3
Brewster	20	25	------	------	45	------	------	------	------	------	4	4
Briscoe	39	------	------	------	39	------	------	------	------	------	3	3
Brooks	16	5	------	------	21	15	3	8	6	10	12	54
Brown	------	------	------	------	------	15	4	8	2	5	15	49
Burleson	4	------	------	------	4	------	------	------	------	------	------	------
Burnet	------	------	------	------	------	------	------	------	------	------	------	------
Caldwell	16	------	------	------	16	68	------	14	------	------	5	87
Calhoun	77	22	------	------	99	8	11	12	6	7	21	65
Callahan	------	------	------	------	------	17	2	34	5	1	57	116
Cameron	29	------	------	------	29	------	1	2	------	2	5	10
Camp	31	------	------	------	31	4	------	2	------	------	1	7
Carson	4	------	------	------	4	133	11	10	3	------	7	164
Cass	84	------	------	------	84	43	3	9	4	1	5	65
Castro	11	39	------	------	50	------	------	------	------	------	2	2
Chambers	108	7	------	------	115	35	11	25	3	3	26	103
Cherokee	6	------	------	------	6	7	6	12	------	------	15	40
Childress	34	10	------	26	70	------	------	------	------	------	2	2
Clay	6	------	------	------	6	36	------	28	8	------	20	92
Cochran	43	------	------	------	43	75	1	3	------	------	10	89
Coke	------	------	------	------	------	38	------	3	2	------	22	65
Coleman	------	------	------	47	47	78	4	33	12	5	45	177
Collin	------	------	------	------	------	------	------	------	------	------	2	2
Collingsworth	5	7	------	------	12	------	41	8	------	------	1	50
Colorado	79	------	------	------	79	2	4	5	3	6	10	30
Comal	------	------	------	------	------	------	------	------	------	------	------	------
Comanche	------	------	------	------	------	2	3	2	------	------	8	15
Concho	6	------	------	------	6	------	------	1	------	1	14	16
Cooke	17	4	------	------	21	138	------	142	21	------	86	387
Coryell	------	------	------	------	------	------	------	------	------	------	1	1
Cottle	24	1	------	31	56	------	------	5	------	------	6	11
Crane	17	------	------	------	17	366	4	24	5	2	13	414
Crockett	89	14	11	------	114	83	11	18	6	2	30	150
Crosby	25	------	------	------	25	3	------	1	1	------	2	7
Culberson	137	17	------	------	154	34	1	8	1	1	34	79
Dallam	24	------	------	------	24	------	3	6	------	------	3	12
Dallas	------	------	------	------	------	------	------	------	------	------	------	------
Dawson	69	------	------	------	69	39	------	2	3	------	9	53
Deaf Smith	24	------	------	------	24	------	------	------	------	------	2	2
Delta	13	1	------	------	14	------	------	------	------	------	1	1
Denton	4	------	------	------	4	------	------	4	------	1	6	11
De Witt	141	------	------	------	141	3	10	4	3	12	12	44
Dickens	------	------	------	------	------	------	------	------	------	------	2	2
Dimmit	44	11	------	------	55	30	12	11	10	4	15	82
Donley	13	13	------	------	26	------	------	1	------	------	3	4
Duval	67	------	------	------	67	115	28	54	24	28	77	326
Eastland	3	------	------	------	3	7	5	5	2	2	5	26
Ector	21	------	------	------	21	690	1	31	11	------	7	740
Edwards	38	28	1	------	67	------	------	------	------	------	3	3
Ellis	------	------	------	------	------	------	------	------	------	------	7	7
El Paso	------	------	------	------	------	------	------	------	------	------	------	------
Erath	2	------	------	------	2	------	1	------	------	2	------	3
Falls	11	------	------	1	12	3	------	4	------	------	4	11

See footnote at end of table.

TABLE 7.—Prospecting and drilling in 1959 by counties [1]—Continued

County	Geophysical prospecting					Drilling						Total
	Seismic	Gravity	Magnetic	Core drill	Total	Development			Exploratory			
						Oil	Gas	Dry	Oil	Gas	Dry	
Fannin												
Fayette	18				18	2	1	3	1		6	13
Fisher	32	9			41	33		11	3	1	22	70
Floyd	15				15							
Foard	31	7			38	20	1	8	3		10	42
Fort Bend	39				39	31	3	17	1		13	65
Franklin	10				10		1	1			4	6
Freestone	10				10	6	1	11	1	1	17	37
Frio	2		11		13	5	2	6	1		8	22
Gaines	100				100	232	8	23	9	1	25	298
Galveston	144	1			145	41	16	23	3	8	6	97
Garza	55				55	127		22	11		29	189
Gillespie												
Glasscock	14				14	7		3	3		7	20
Goliad	31				31	1	12	13	1	20	22	69
Gonzales	257				257			2			20	22
Gray	3				3	86	63	5	1		4	159
Grayson	79	7			86	18		4	12	1	9	44
Gregg						35	5	4	2		1	47
Grimes	18	8			26						1	1
Guadalupe	8				8	45	2	4			14	65
Hale	6				6	1					2	3
Hall	53	3			56						2	2
Hamilton											1	1
Hansford						17	38	22	2	10	6	95
Hardeman	60	15		24	99			1	1		7	9
Hardin	31				31	62	3	27	1	3	13	109
Harris	44				44	90	7	50	2	3	15	167
Harrison	2				2	123	13	11	4		7	158
Hartley	11				11		1				3	4
Haskell						114		48	4		53	219
Hays											1	1
Hemphill	12				12	1	1	1	1		5	9
Henderson	16				16	1	3				13	17
Hidalgo						13	55	20	1	14	26	129
Hill	3				3			9	1		10	20
Hockley	53				53	40		2	3		12	57
Hood												
Hopkins	27				27	1					4	5
Houston	16				16	2	2	3		2	10	19
Howard	20	4	7		31	154		10	6		13	183
Hudspeth												
Hunt	16				16			1			1	2
Hutchinson	1				1	294	8	13	2	1	12	330
Irion	7	2	2		11	21	1	11	7		17	57
Jack	6				6	106	26	80	8		28	248
Jackson	56	1			57	19	25	27	21	28	26	146
Jasper	45				45	10		2	4		7	23
Jeff Davis											1	1
Jefferson	154	3			157	28	34	20		10	21	113
Jim Hogg	33				33	22	6	9	1	6	30	74
Jim Wells	7				7	22	23	23	13	17	21	119
Johnson				9	9						1	1
Jones						77		60	17		98	252
Karnes	122				122	19		2	1		15	37
Kaufman	1				1	1		1			3	5
Kendall												
Kenedy	12	40			52		2	3		3	9	17
Kent	5				5	23		9	1		7	40
Kerr											1	1
Kimble								4			2	6
King	20				20	5	2	3	1		20	31
Kinney	14				14							
Kleberg	38	13			51	13	10	3	11	7	7	51
Knox	2				2	83		70	7		54	214
Lamar											1	1
Lamb	19	23			42	8		1			10	19
Lampasas												
La Salle	22				22	15	6	13	2		13	49
Lavaca	82				82		7	3	2	6	10	28
Lee	4				4						1	1
Leon	4			8	12	2	10	7		1	12	32
Liberty	51				51	52	8	34	2	3	17	116
Limestone	26			15	41	2	2	3		2	10	19

See footnote at end of table.

TABLE 7.—Prospecting and drilling in 1959 by counties[1]—Continued

County	Geophysical prospecting					Drilling						Total
	Seismic	Gravity	Magnetic	Core drill	Total	Development			Exploratory			
						Oil	Gas	Dry	Oil	Gas	Dry	
Lipscomb	7				7	10	2	2	6	6	13	39
Live Oak	101				101	36	14	28	13	13	53	157
Llano												
Loving	15				15	97	3	27	4		46	177
Lubbock	32				32	1					5	6
Lynn	40				40	15		4	3		12	34
McCulloch							1			2	8	11
McLennan	1				1	1					1	2
McMullen	39				39	28	14	22	4	2	42	112
Madison	13				13	1	3	1		1		6
Marion	12				12	9		4	3	1	6	23
Martin	31				31	11		1	3		12	27
Mason												
Matagorda	192	4			196	25	17	21	5	17	22	107
Maverick	34		12		46	71	2	22	4		17	116
Medina	9				9	2		1			8	11
Menard						3					8	11
Midland	4				4	88	18	3	2		4	115
Milam	2	2	4		8						6	6
Mills											2	2
Mitchell	9	1			10	86		6	1		1	94
Montague	5				5	37	1	32	3		18	91
Montgomery	11	1			12		8	3			5	16
Moore	6				6	9	11	2		2	2	26
Morris	22				22						1	1
Motley	5			19	24	7		6	1		6	20
Nacogdoches	8				8	1	1					2
Navarro	1				1	227		14			9	250
Newton	79	8			87	6	2	4	3	1	10	26
Nolan	31				31	31	1	21	3	1	19	76
Nueces	29	6			35	24	6	22	17	13	32	114
Ochiltree	2				2	104	32	21	15	12	6	190
Oldham	10				10				1		8	9
Orange	43				43	13	2	8			11	34
Palo Pinto						22	8	16	1	15	27	89
Panola						1	5	5			2	13
Parker						10	11	21	2	4	8	56
Parmer	9				9							
Pecos	268	2			270	169	25	35	11	5	55	300
Polk	23	1			24	1	2	3	2		3	11
Potter	22				22		3				1	4
Presidio	15	41			56							
Rains	5				5							
Randall	17				17						4	4
Reagan	9	1			10	48		6	2		3	59
Real												
Red River	15				15	2		8			17	27
Reeves	251	1			252	137	1	24	2		54	218
Refugio		1			1	42	23	13	17	8	19	122
Roberts	6				6	7	11	3	3	2	15	41
Robertson	37			10	47		4	3		2	4	13
Rockwell												
Runnels	1			59	60	53	7	25	16	4	67	172
Rusk	14				14	70	11	10	4	5	9	109
Sabine	8				8							
San Augustine												
San Jacinto	69	17			86	1	1	2			5	9
San Patricio	22	1			23	20	35	23	17	22	36	153
San Saba												
Schleicher	47	3			50	21	15	14	4	3	28	85
Scurry	37	4			41	180		18	1		10	209
Shackelford	10			13	23	61	3	46	15	1	65	191
Shelby	5				5	2		7	1	1	14	25
Sherman						2	14	13		1	5	35
Smith	57			13	70	61	3	9	10	1	20	104
Somervell												
Starr	76				76	44	19	32	23	17	35	170

See footnote at end of table.

TABLE 7.—Prospecting and drilling in 1959 by counties [1]—Continued

County	Geophysical prospecting					Drilling						Total
	Seismic	Gravity	Magnetic	Core drill	Total	Development			Exploratory			
						Oil	Gas	Dry	Oil	Gas	Dry	
Stephens	47	------	------	------	47	39	17	19	7	4	16	102
Sterling	2	11	7	------	20	20	------	12	2	------	8	42
Stonewall	67	------	------	------	67	42	------	31	12	------	30	115
Sutton	38	------	------	------	38	------	5	------	2	1	8	16
Swisher	45	------	------	------	45	------	------	------	------	------	------	------
Tarrant	------	------	------	------	------	------	------	------	------	------	------	------
Taylor	20	------	------	2	22	229	------	117	32	------	110	488
Terrell	124	30	------	------	154	------	4	1	------	------	8	13
Terry	30	------	------	------	30	21	------	6	1	------	7	35
Throckmorton	52	------	------	14	66	37	------	32	16	2	26	113
Titus	47	------	------	------	47	29	------	10	5	------	12	56
Tom Green	17	5	5	------	27	13	1	12	1	1	18	46
Travis	------	3	------	------	3	2	------	4	------	------	23	29
Trinity	5	------	------	------	5	------	------	------	------	------	------	------
Tyler	64	3	------	------	67	25	------	5	1	------	7	38
Upshur	------	------	------	------	------	21	------	2	1	------	8	32
Upton	22	------	------	------	22	168	2	8	2	1	6	187
Uvalde	3	------	------	------	3	------	------	------	------	------	------	------
Val Verde	186	50	5	------	241	3	------	------	2	------	7	12
Van Zandt	89	------	------	------	89	2	1	3	------	------	5	11
Victoria	16	------	------	------	16	17	22	21	4	8	24	96
Walker	17	10	------	------	27	------	------	1	------	------	2	3
Waller	4	------	------	------	4	------	------	------	------	------	1	1
Ward	27	1	------	------	28	277	16	23	6	3	14	339
Washington	22	4	------	------	26	11	------	1	1	------	------	13
Webb	119	------	------	------	119	16	7	24	4	12	56	119
Wharton	13	------	------	------	13	24	12	42	1	6	10	95
Wheeler	2	------	------	------	2	42	24	10	------	------	1	77
Wichita	6	------	------	------	6	79	------	37	3	------	13	132
Wilbarger	5	------	------	------	5	56	------	15	6	------	54	131
Willacy	23	------	------	------	23	------	------	------	3	------	2	5
Williamson	------	1	1	------	2	------	------	------	------	------	13	13
Wilson	19	------	------	------	19	14	------	37	1	------	32	84
Winkler	33	8	------	------	41	299	46	34	3	3	9	394
Wise	------	------	------	------	------	70	84	16	21	3	4	198
Wood	12	------	------	------	12	10	------	9	7	------	7	33
Yoakum	26	------	------	------	26	139	------	10	5	------	27	181
Young	49	------	------	------	49	145	3	101	18	1	50	318
Zapata	101	------	------	5	106	4	8	11	------	7	24	54
Zavala	21	6	15	------	42	2	3	2	1	1	47	56
Offshore	57	49	------	------	106	------	------	------	1	1	4	6
Totals	7,207	653	104	300	8,264	8,928	1,242	2,785	763	474	3,372	17,564

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[1] International Oil Scouts Association and Society of Petroleum Engineers of AIMI, International Oil and Gas Development, vol. 30.

Petroleum.—With excessive stocks of crude oil and major refined products continuing through most of 1959, with crude oil imports averaging near-record levels, and with crude oil and wholesale prices of refined products dropping, the oil producers, refiners, and regulatory agencies were considering means of solving these pressing problems and protecting the industry's markets. The industry was investing in new and more efficient equipment, unitizing oil and gas reservoirs, and instigating other new production practices to increase output and lower costs. Producers and regulatory bodies were considering reapportionment of output to new wells, to strippers, and to secondary-recovery production, to wider field spacing of wells, and the reduction of the number of wells exempt from allowable regulations. Most of the capital expenditures of the industry were for modernization and upgrading of quality rather than expansion of capacities. The State's 188,934 oil wells produced at a rate of 2,695,500 barrels daily or 14.2 barrels per well daily, compared with 2,575,800 barrel daily production or 14.1 barrels per well daily in 1958. Crude oil was reported from 196 of the State's 254 counties. The five leading counties in the order of their production were: Andrews, Ector, Crane, Scurry, and Gaines. The average daily indicated demand for crude oil was 2,712,700 barrels, up 4.4 percent from 1958. A total of 4,609 exploratory wells were drilled by the oil and gas industry in 1959, resulting in the discovery of 439 oilfields and 73 gasfields. Counties with the greatest number of new discoveries, were: Jackson 28, Starr 24, San Patricio 23, Duval 21, and Refugio 20. Beginning crude oil stocks at the Texas refineries as of December 31, 1958, were 96,067,000 barrels; stocks were 111,132,000 barrels as of December 31, 1959. Texas refineries received 992,403,000 barrels of crude oil in 1959, of which 605,258,000 barrels was produced in the State, 1,062,000 barrels was received from Alabama and Mississippi, 98,875,000 from Louisiana, 56,847,000 from New Mexico, 3,460,000 from Oklahoma and 3,527,000 from Utah. Pipelines carried 69 percent of the receipts, railroads and trucks 1 percent, and boats and barges 8 percent. At the end of 1959, 55 refineries were operating in Texas at a rated capacity of 2,631,820 barrels daily, 96.7 percent of total capacity. Texas refinery capacity was 26.5 percent of total domestic capacity. The daily average run to stills was 2,130,840 barrels, and Texas production represented 78.4 percent of receipts. These refineries were in 31 counties. A 32-day strike at the Port Arthur refinery of Gulf Oil Co. ended March 1 with agreement on job assignments.

TABLE 8.—Daily average production and runs to stills of petroleum

(Thousand barrels)

Month	1958		1959	
	Crude production	Runs to stills	Crude production	Runs to stills
January	2,728	2,034	2,913	2,239
February	2,749	1,942	2,884	2,065
March	2,337	1,963	2,885	2,199
April	2,277	1,935	2,837	2,164
May	2,220	1,887	2,868	2,274
June	2,293	1,905	2,706	2,079
July	2,419	1,996	2,488	2,031
August	2,731	2,084	2,481	2,148
September	2,889	2,068	2,517	2,071
October	2,701	2,126	2,528	2,005
November	2,744	2,092	2,560	2,118
December	2,852	2,150	2,692	2,168

TABLE 9.—Runs to stills and output of refineries in 1959, by month

(Thousand barrels)

Month	Runs			Output					
	Crude	Products	Rerun	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous
						Distillate	Residual		
January	69, 401	5, 488	−703	36, 057	4, 704	19, 004	6, 319	2, 017	6, 085
February	57, 822	5, 113	−782	28, 114	4, 152	15, 906	5, 755	2, 199	6, 027
March	68, 170	6, 556	−3, 014	34, 910	3, 306	16, 426	6, 316	2, 586	8, 168
April	64, 921	6, 089	−2, 166	34, 772	2, 524	15, 601	5, 548	2, 157	8, 242
May	70, 485	6, 499	−3, 966	37, 138	2, 659	16, 364	5, 826	2, 387	8, 644
June	62, 372	6, 660	51	35, 742	2, 429	15, 030	5, 071	2, 272	8, 539
July	62, 969	6, 850	−2, 963	35, 461	1, 958	14, 110	4, 732	2, 300	8, 295
August	66, 599	6, 804	−1, 760	36, 737	2, 620	15, 448	5, 911	2, 820	8, 107
September	62, 138	6, 550	−3, 130	33, 883	2, 820	14, 037	4, 792	2, 317	7, 709
October	62, 152	6, 851	−1, 211	34, 804	3, 460	14, 282	5, 017	2, 567	7, 662
November	63, 528	6, 584	−2, 080	34, 489	3, 622	14, 974	4, 847	2, 612	7, 488
December	67, 201	6, 668	−1, 238	36, 935	3, 949	15, 766	5, 471	3, 071	7, 439
Total:									
1959	777, 758	76, 712	−22, 962	419, 042	38, 203	186, 948	65, 605	29, 305	92, 405
1958	735, 839	68, 878	−174	397, 935	40, 412	179, 301	77, 191	23, 588	86, 116

TABLE 10.—Stocks of crude petroleum at refineries, tank farms, and gathering systems in 1959, by months

(Thousand barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January	15, 210	71, 275	7, 219	93, 704
February	15, 507	71, 548	7, 744	94, 799
March	16, 224	67, 818	7, 589	91, 631
April	16, 294	70, 251	7, 434	93, 979
May	16, 096	71, 424	7, 844	95, 364
June	17, 343	74, 752	7, 304	99, 399
July	15, 890	71, 677	7, 354	94, 921
August	14, 565	66, 964	7, 199	88, 728
September	15, 524	65, 699	7, 094	88, 317
October	15, 793	66, 856	7, 389	90, 038
November	14, 863	68, 360	7, 659	90, 882
December	14, 942	69, 923	7, 404	92, 269

TABLE 11.—Stocks of refined products by refineries in 1959 with plants and pipelines by months

(Thousand barrels)

Month	Gasoline [1]	Kerosine	Fuel oil		Jet fuel	Natural-gas liquids	Miscellaneous products
			Distillate	Residual			
January	35, 586	2, 076	11, 183	8, 127	1, 659	441	22, 347
February	36, 299	2, 341	9, 711	7, 347	1, 712	468	22, 175
March	37, 399	3, 004	10, 256	7, 871	2, 116	453	23, 367
April	34, 632	3, 444	11, 522	7, 222	2, 215	551	23, 757
May	35, 471	3, 973	14, 792	7, 316	2, 188	500	25, 855
June	33, 066	4, 211	17, 154	7, 757	2, 235	527	23, 657
July	29, 942	3, 456	18, 814	7, 667	2, 068	402	24, 145
August	28, 856	3, 423	21, 134	8, 704	2, 262	496	23, 313
September	27, 607	3, 703	21, 889	8, 638	2, 052	572	23, 112
October	28, 290	3, 874	22, 731	8, 652	1, 762	560	22, 251
November	30, 011	3, 412	23, 843	8, 289	2, 108	506	22, 860
December	31, 461	3, 138	19, 641	7, 585	1, 995	595	21, 380

[1] Includes naphtha.

New additions and expansions were made to the State's refining facilities. Humble Oil & Refining Co. installed an analog computer system for research and development of new processes for refinery units at its Baytown refinery. A $3 million modernization program at the Mount Pleasant refinery of American Petrofina Co. of Texas included a platformer, a 1,500-barrel-a-day HF-alkylation unit and related facilities. Texaco, Inc., began construction of a 1,600-barrel-a-day alkylation unit at its El Paso refinery. A unique arrangement for servicing an alkylation unit between a small refinery and a petrochemical and chemical manufacturer was put into effect in the Houston area. A 3,000-barrel-a-day alkylation unit was built at the 200,000-ton-a-year butadiene plant of Petro-Tex Chemical Corp. For this unit, Republic Oil Refining Corp. furnished half the feedstock, a butylene-butane iso-butane stream from its Texas City refinery. Thus, Republic Oil Co. secured an outlet for its butanes and butylenes in return for alkylate needed for upgrading its own motor gasoline. Shamrock Oil & Gas Co. added an 8,000-barrel-a-day fresh-feed Thermofor catalytic cracker at its McKee refinery. A unit to produce 2,500 barrels a day of heavy aromatic and aliphatic solvents was completed at the Corpus Christi refinery of Delhi-Taylor Oil Corp. Texas City Refining, Inc., added a 7,000-barrel-a-day Houdriformer to its Texas City refinery.

Three quadruple well completions of Humble Oil & Refining Co. were approved by the Railroad Commission of Texas; two completions from four oil zones in the North Alazon field and one completion from four gas zones in the Stratton field, all in Kleberg County. The only prior quadruple completion in Texas was Magnolia Petroleum Co's No. 8 Santa Cruz Farms in the Don Carlos field in Hildago County. The first oil-well completion on the outer Continental Shelf was completed by Standard Oil Co. of Texas, with flow from lower Miocene formations at 8,520 to 8,526 feet deep.

Petrochemicals.—A major part of the petrochemical industry of the United States was located along the Gulf Coast of Texas. The industry was steadily increasing its contribution to the total production of chemicals in the Nation. The industry was consuming greater quantities of petroleum fractions and natural gas in producing a wide variety of derivatives to be used in synthetics, detergents, rubber, and plastics. The importance of the petrochemical industry to the State's economy was shown by the 1958 Census of the Chemical and Allied Products group, which increased the value of chemical products manufactured in the State by $1,063 million or nearly 21 percent of the value added by all major industrial production. Texas chemical producers likewise spent nearly $200 million on capital improvements in 1958. Major centers of the State's petrochemical industry included the Beaumont-Orange area, the Houston-Galveston area, Corpus Christi, Brownsville, and Odessa. During 1959, Phillips Chemical Co. increased the ethylene capacity of its Sweeney plant by 35 million pounds to a total of 290 million pounds a year. Construction was begun by Texas Alkyls, Inc., on a new Houston plant to produce 1 million pounds of aluminum alkyls a year. These alkyls are special catalysts used in manufacturing polyethylene. Full operation was resumed at the butadiene plant of Humble Oil and

Refining Co. Baytown refinery when the fourth unit was put onstream at midyear. Plant operations had been shut down since early 1958. A multipurpose electronic computor unit to facilitate upgrading of hydrocarbon feedstocks, produce numerous types of chemicals, and evaluate process and other technical problems, was added to the Philtex plant of Phillips Chemical Co. A new unit to polymerize butylenes was added to the Channelview petrochemical plant of Texas Butadiene and Chemical Co. Cosden Petroleum Co. completed expansion of its Big Spring polybutylene plant, doubling its capacity to 2 million gallons a year.

NONMETALS

The value of the nonmetals produced in Texas was $293 million, or 6.9 percent of the total value of all minerals. Of 18 nonmetals reported, the 5 principal commodities in order of value were: Cement, sulfur, stone, sand and gravel, and bromine. Most of the nonmetal markets were local; only a few were in other States. All construction materials showed marked increases in output, owing primarily to the expanded interstate highway program and to a continuing high level of public, industrial, and residential construction.

Abrasives.—A limited quantity of grinding pebbles (abrasives) was reported produced in Travis County. The demand for this type of abrasive had been declining for several years.

Barite.—Crude barite from other States and from foreign countries was ground and processed principally for drilling muds used by the oil and gas industry. The quantity and value of this processed material was less than in 1958 because of curtailed drilling activity. The crude barite was processed at the Corpus Christi plant of Baroid Division of National Lead Co., at the Brownsville plant of Magcobar, Inc., and at the Carthage and Houston plants of The Milwhite Co.

Bromine.—Texas remained one of the leading States in the recovery of bromine. Ethyl-Dow Chemical Co., which recovered the bromine from sea water at its Freeport (Brazoria County) plant, was the Nation's leading producer. The quantity and value was less than in 1958. Most of the bromine was consumed as ethylene dibromide, an additive in antiknock compounds. The oil-refining industry of Texas consumed most of the bromine, but large quantities were shipped to out-of-State markets.

Cement.—Production, shipments, and value of cement in Texas established new records as the industry expanded and improved its production, handling, and storage facilities during the year. Output was raised 7 percent, and shipments increased 8 percent. Cement was made at 15 plants in 10 counties, 1 more plant and 1 more county than in 1958. Limestone was the basic raw material for 11 of the inland cement plants, and 4 plants along the Gulf Coast used shell as raw material. The new Douro plant of Southwestern Portland Cement Co. near Odessa had an annual capacity of 1.25 million barrels. The plant cost approximately $12 million. Initial production began May 3, and the plant operated at about 80 percent of capacity throughout the remainder of the year. Limestone was obtained from a quarry about 1 mile from the plant. Outside storage of all raw materials, a feature of this operation, was possible because of the extremely dry climate. The quarry face was approximately 20 feet high. The ore was limestone with some interbedded shale seams, permitting one mining operation to supply both limestone and clay requirements for cement. Two 4-yard shovels, one electric and one diesel, loaded the broken rock into 30-ton, side-dump, semitrailer trucks, which carried the material to a crusher at the plant. The crushed material was automatically transported by belt conveyor to an outside stockpile area. The stockpiled material was reclaimed as needed by an underground belt conveyor directly beneath the stockpile, and delivered to ball mills for further reduction. Construction of a 1.4-million barrel plant costing approximately $14 million was begun by Texas Industries, Inc. at Midlothian. Limestone was to be quarried adjacent to the plant. Production was scheduled for late 1960, and about 100 workers were to be employed.

TABLE 12.—Destination of shipments of all types of finished portland and high-early-strength cement to Texas from mills

Year	Texas (thousand barrels)	Change, percentage	
		In Texas	In United States
1950–54 (average)	17,160		
1955	20,782	+8	+6
1956	20,954	+1	+6
1957	18,891	−10	−6
1958	22,323	+18	+6
1959	23,884	+7	+9

TABLE 13.—Portland cement produced and shipped

(Thousand barrels and thousand dollars)

Year	Production (quantity)	Shipments	
		Quantity	Value
1950–54 (average)	19,215	19,168	$47,108
1955	24,241	24,038	64,820
1956	25,655	25,234	73,070
1957	21,845	21,547	66,201
1958	25,465	25,209	77,186
1959	27,111	27,215	85,022

Clays.—Clay production established a new record, exceeding the previous record set in 1958 by 4 percent in quantity and 5 percent in value. Increases were reported in both quantity and value for bentonite, fuller's earth, and fire clay; miscellaneous clay alone reported a decline from 1958. Bentonitic clay production increased 10 percent over 1958 with Angelina, Walker, and Gonzales the major producing counties. Clays for heavy drilling muds consumed nearly 80 percent of the output; the remaining 20 percent was used for filtering and decolorizing. Output of fire clay was 44 percent greater than that of 1958; production was reported in 10 counties. Rusk, Bastrop, and Harrison Counties were the principal producers. Heavy clay products, building and paving brick, drain tile, sewer pipe, and kindred commodities, used nearly 70 percent of the output, and refractories used the remainder. Production of fuller's earth in Briscoe and Fayette Counties increased nearly 60 percent, compared with 1958. Principal uses were as decolorizing agent for vegetable and mineral oils, additive for drilling muds, carrier for insecticides, and filtering and clarifying agents. Miscellaneous clay output decreased 3 percent in quantity and 7 percent in value, compared with 1958. The clay came from 35 counties; Harris, Eastland, Dallas, Bexar, and Fort Bend Counties led in production. Over 90 percent of the clay was used in manufacturing brick, heavy clay products, and cement. Lightweight aggregate and tile manufacturing used the remainder.

District 1 of the Texas Highway Department developed a process to produce a fired-clay aggregate as a substitute for natural gravel in highway construction. This process is important to highway construction projects in areas lacking natural gravel deposits, since usable surface clay deposits are widely distributed over the State. American Aggregate Co., Inc., of Austin, added 2 new 10- by 150-foot kilns to its Eastland County plant to more than double its capacity to 812 carloads of expanded aggregate a month. The company also acquired 45 acres of shale deposits to improve its reserve position.

Gem Stones.—Gem stones and semiprecious stones of various qualities and types were found in Texas in 1959. The gems found were various types of agate, geodes, cycads, agatized wood, tektites, topaz, smoky quartz, and garnet.

TABLE 14.—Clays sold and used by producers

(Thousand short tons and thousand dollars)

Year	Bentonite		Fire clay		Fuller's earth		Miscellaneous clay		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity [2]	Value [2]
1950–54 (average)	50	$618	338	$1,121	106	$1,249	1,725	$2,034	2,219	$5,022
1955	155	1,462	437	1,068	(1)	(1)	2,504	2,569	3,096	5,099
1956	161	1,183	483	1,007	(1)	(1)	2,502	2,575	3,146	4,765
1957	127	963	454	1,057	(1)	(1)	2,411	2,913	2,992	4,933
1958	121	889	501	1,135	(1)	(1)	3,097	3,400	3,719	5,424
1959	133	947	722	1,596	(1)	(1)	3,015	3,160	3,870	5,703

[1] Figures withheld to avoid disclosures of individual company confidential data.
[2] Incomplete total, excludes Fuller's earth.

Graphite.—Natural, crystalline-flake graphite was quarried and refined by one producer in Burnet County. Production was greater than in 1958.

Gypsum.—Crude gypsum production established a new record in 1959, exceeding the previous record set in 1955, by about 1 percent and the 1958 output by 9 percent. The increase was due to the continued demand for building and construction materials such as wallboard, lath, exterior sheathing, and plaster. A minor quantity of the crude gypsum was used as a retarder in cement. Production was reported by six operators from Fisher, Hardeman, Hudspeth, and Nolan Counties. United States Gypsum Co. remained the principal producer.

TABLE 15.—Gypsum mined

Year	Crude gypsum mined		Year	Crude gypsum mined	
	Short tons	Value		Short tons	Value
1950–54 (average)	1,104,028	$3,015,117	1957	1,043,236	$3,343,217
1955	1,349,434	4,219,652	1958	1,240,050	4,120,311
1956	1,156,956	3,623,005	1959	1,351,060	4,770,228

Lime.—Lime production established a new record, exceeding the 1957 record by 2 percent. Quicklime was 51 percent of the output and hydrated lime the remainder. Production was reported from 10 plants in 8 counties. Limestone was used to manufacture 55 percent of the hydrated lime, and shell used to produce the remaining 45 percent. A large quantity of lime was used as a soil stabilizer for roads, airport runways, and parking lots. One to six percent lime (13,000 tons), was used to stabilize 1¼ million square yards of clay subgrade at the Bergstrom Air Force Base at Austin. The lime waterproofed the clay subgrade, thus permitting quick drying and providing protection against cracking of the asphalt seal over the clay.

TABLE 16.—Lime (quick and hydrated) sold by producers

Year	Quick lime (short tons)	Hydrated lime (short tons)	Total	
			Short tons	Value (thousands)
1950–54 (average)	229,678	130,523	360,201	$3,406
1955	307,322	277,533	584,855	5,549
1956	349,693	242,443	592,136	6,938
1957	559,426	236,968	796,394	7,489
1958	414,302	276,359	690,661	7,146
1959	414,052	394,725	808,777	8,530

Lithium.—Lithium hydroxide and other lithium compounds were processed from imported lepidolite ores at the San Antonio plant of American Lithium Chemicals, Inc. Most of the output was consigned to the Atomic Energy Commission (AEC) for nuclear research.

Magnesium Compounds.—Production of magnesium compounds, including magnesium chloride used for metal, was slightly less than in 1958. Production was reported from the Dow Chemical Co., plant at Freeport, Brazoria County.

Natural Salines.—Natural sodium sulfate was recovered from salt brines in Terry and Ward Counties by Ozark-Mahoning Co. Most of the sodium sulfate was used in preparing salt cake.

Perlite.—Crude perlite was not produced in Texas, but six plants in four counties expanded crude material received from western States. The expanded product was used as lightweight aggregate in plaster and concrete, and as grouting in oil wells. Output of the expanded material was much greater than in 1958.

Phosphate Rock.—Phosphate rock, although not produced in the State, was used in significant quantities as a major component of mixed fertilizers. Most of the crude phosphate rock came from

Florida, and a large amount from Tennessee. Superphosphate and triple superphosphate were also imported.

Pumice (Volcanic Ash).—Pumice was mined from open pits in Dickens County for use principally as an oil and grease absorbent.

Salt.—Salt was recovered from underground mines and wells. Output was 18 percent greater, and value 16 percent greater than in 1958; however, the 1959 production did not exceed the record established in 1957. Evaporated salt accounted for 2 percent of the total, rock salt for 6 percent, and brine for the remaining 92 percent. Output was reported by 10 producers from 9 counties. Most of the production was consumed by the State's chemical industry in manufacturing chlorine, hydrochloric acid, other chlorine compounds, and sodium compounds.

TABLE 17.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950-54 (average)	2,521	$5,114	1957	4,612	$17,104
1955	3,583	12,867	1958	3,843	15,115
1956	3,963	14,370	1959	4,519	17,498

Sand and Gravel.—A record 35.3 million tons of sand and gravel valued at $34.7 million was produced, exceeding 1958 output by 7 percent in quantity and 13 percent in value. Production was reported from 114 counties by 160 commercial and 50 noncommercial operations. Commercial production accounted for 84 percent of the quantity and 92 percent of the value. Washed material accounted for 89 percent of the commercial output with an average value of $1.16 a ton, whereas only 16 percent of the noncommercial sand and gravel was washed or processed. Average value of all sand and gravel produced was $0.98 a ton, compared with $0.94 a ton in 1958. Sand consumption by use was: Building, 54 percent; paving, 35 percent; fill, 6 percent; railroad ballast, other construction, and glass, 1 percent each; molding, blast, engine, filtration, hydrafrac, other industrial, and foundry sands, 2 percent. Gravel consumption by use was: Building, 36 percent; paving, 58 percent; fill and miscellaneous, 2 percent each; and railroad ballast and other construction, 1 percent each. The sand and gravel was moved by truck (73 percent), rail (25 percent), and water (2 percent).

TABLE 18.—Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government and contractor		Total sand and gravel	
	Quantity	Value	Quantity	Value	Quantity	Value
1950-54 (average)	16,277	$16,594	3,031	$670	19,308	$17,264
1955	24,973	26,303	6,545	2,177	31,518	28,480
1956	23,311	25,512	6,025	1,701	29,336	27,213
1957	19,155	21,979	4,530	1,448	23,685	23,427
1958	27,015	28,703	5,856	2,105	32,871	30,808
1959	29,520	32,098	5,775	2,628	35,295	34,726

Stone.—The total quantity of stone produced, including shell, was 42,171,527 tons valued at $47,787,325, 17 percent greater in both quantity and value than in 1958. Commercial stone accounted for 75 percent of the quantity and 85 percent of the value and averaged $1.29 a ton. Dimension stone was produced from granite, limestone, and sandstone and amounted to 85,233 tons valued at $2,075,226, averaging $24.35 a ton. Limestone accounted for 69 percent of the gross output, shell for 24 percent, and sandstone for nearly 6 percent. The remainder was basalt, granite, marble, and miscellaneous stone.

Asphaltic Limestone.—Native asphalt was quarried and processed for highway surfacing and road maintenance by two operators in Uvalde County.

Granite.—Crushed and dimension granite were produced in three counties; output was considerably lower than that of 1958. Crushed granite was used primarily for riprap. Dimension granite was used for dressed architectural stone, rough and dressed monumental stone, and paving blocks.

Limestone.—Crushed limestone was produced in 59 counties by 88 operations, 45 of which were commercial. Value increased 22 percent and production 14 percent. Commercial production accounted for 72 percent of the gross with an average value of $1.10 a ton. Nearly 81 percent of the crushed limestone was used as roadstone and aggregate in concrete; other important uses included riprap, metallurgical flux, railroad ballast, asphalt filler, and aglime. Over 67 percent of the crushed limestone was hauled by truck, and 25 percent by rail. The five principal limestone-producing counties in order of output were Bexar, Wise, Dallas, Travis, and Comal. The quantity of dimension limestone reported by eight producers from five counties was 16 percent less than in 1958, but the value was approximately the same. Rough architectural stone accounted for 31 percent of the use, dressed building stone for 60 percent, and rubble for the remainder. The dimension stone value averaged $1.45 a cubic foot.

Marble.—Marble was quarried and prepared as terrazzo, roofing material, and paint pigment by one producer in Llano County.

Miscellaneous Stone.—Miscellaneous stone, including rhyolite, graphitic schist, and magnetite, was quarried and crushed for use as roadstone, aggregate in concrete, riprap, filtering medium, and railroad ballast by three producers in two counties. Both the quantity and value were down considerably from 1958.

TABLE 19.—Stone sold or used by producers

(Thousand short tons and thousand dollars)

Year	Limestone		Sandstone		Shell		Miscellaneous		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity [2]	Value [2]
1955	14,103	$16,081	(1)	(1)	11,085	$14,763	724	$700	27,321	$33,544
1956	18,706	18,357	1,286	$1,244	12,018	15,483	700	636	32,773	36,350
1957	19,423	20,509	1,810	1,587	9,650	12,640	(1)	(1)	31,249	36,154
1958	25,470	24,794	997	851	9,035	12,684	404	803	36,076	40,912
1959	29,141	30,064	2,406	1,189	10,310	14,419	177	257	42,172	47,787

(1) Included in total; Bureau of Mines not at liberty to publish.

[2] Includes certain stone: Bureau of Mines not at liberty to publish separately.

Sandstone.—The output of crushed sandstone, reported by 16 producers from 13 counties, was more than double that of 1958. Nearly 96 percent of the crushed sandstone was produced for Texas highway department districts as aggregate in concrete and for road surfacing. Dimension sandstone for use as rubble and in rough construction was reported by two producers from two counties.

Shell.—Shell output from seven Gulf coast bays increased 14 percent in both quantity and value as compared with 1958. The major part of this output was used in manufacturing cement and lime; sizable quantities were used for aggregate in concrete and for road surfacing.

Sulfur.—Frasch sulfur production held steady in 1959, but shipments increased 13 percent and value 12 percent as demand reached record levels. Sulfur exports were near the 1956 record high. Output of sulfur recovered from sour gas and sour crude petroleum also was about the same, but shipments rose 9 percent in tonnage and 7 percent in value, compared with 1958. Competition increased during the year for both domestic and foreign markets as a result of new producers in Mexico, Canada, and France. The Sulfur Institute, composed of both domestic and foreign producers, was organized for research and development of markets for sulfur.

Talc and Soapstone.—The output of crude talc was approximately the same as that of 1958, and came from seven operations in two counties. Further development of the new Allamore talc deposits continued during the year. Five companies reported production, and four additional companies engaged in exploration or development. A 120-ton-a-day grinding mill was being built by Pioneer Talc Co. at Allamore, and provisions were made to add a 100-ton unit if necessary.

Vermiculite (Exfoliated).—Crude vermiculite from other States and foreign countries was processed at four plants in three counties for use as lightweight aggregate in plaster and for loose fill insulation.

TABLE 20.—**Sulfur produced and shipped from Frasch mines**

(Thousand long tons and thousand dollars)

Year	Production	Shipments		Year	Production	Shipments	
		Quantity	Value			Quantity	Value
1950–54 (average)	3,744	3,773	$86,301	1957	3,366	2,880	$70,225
1955	3,658	3,767	105,128	1958	2,588	2,616	61,621
1956	3,994	3,437	91,026	1959	2,519	2,970	68,998

Water.—Water remained a prerequisite to the continued development of the tremendous reserves of natural resources in Texas and for maintaining its industrial economic growth. Comprehensive programs to develop adequate industry and municipal water supplies were being studied by State, Federal, and local agencies. A $10 million authorization by the 85th Congress to build five plants (three to convert sea water, and two to convert brackish water to potable quality at the rate of 1 million gallons a day) was one of several major projects directed toward solving the water problem. The Office of Saline Water (OSW) of the U.S. Department of the Interior chose the Gulf coast as the location for the first demonstration plant. Thirty-one gulf communities submitted bids for the facility. OSW chose the multistage Flask-distillation process for its first installation. Heat source for this process would probably be a low-temperature atomic reactor operating in the 300° F. range. The program called for conventional steam-generating units to operate the plant for at least a year while the reactors were being built.

METALS

Metallic mineral production in Texas was limited to iron, magnesium, mercury, and uranium, but a large number of metallurgical plants processed ores and other materials mined in other States and in foreign countries. Metals produced in these plants included aluminum, antimony, cadmium, copper, ferroalloys, lead, rare-earth metals, tin, tungsten, and zinc. Scrap aluminum, brass, iron, lead, and zinc were treated at 12 secondary smelters.

TABLE 21.—Smelters, refineries, and reduction plants in 1959

Product, company, and plant	Location, county	Material treated	Source of material
Aluminum:			
Aluminum Co. of America:			
Point Comfort (alumina)	Calhoun	Bauxite	Foreign.
Point Comfort (reduction)	do	Alumina	
Rockdale (reduction)	Milam	do	
Reynolds Metals Co.:			
La Quinta (alumina)	San Patricio	Bauxite	Foreign.
San Patricio (reduction)	do	Alumina	
Antimony: National Lead Co: Laredo smelter	Webb	Ore	Foreign.
Cadmium: American Smelting & Refining Co; electrolytic.	Nueces	Flue Dust	Do.
Copper:			
American Smelting & Refining Co.: El Paso smelter.	El Paso	Ore and concentrates.	Foreign and domestic.
Phelps Dodge Refining Corp: Nichols refinery.	do	Blister and anode	Domestic.
Iron:			
Lone Star Steel Co.: Daingerfield plant	Morris	Ore and scrap	Foreign and domestic.
Sheffield Div. of Armco Steel Corp.: Houston plant.	Harris	do	Do.
Lead: American Smelting & Refining Co.: El Paso smelter.	El Paso	Ore and concentrates.	Foreign.
Magnesium: Dow Chemical Co.: Freeport plant	Brazoria	Seawater	
Manganese: Tenn-Tex Alloy & Chemical Co	Harris	Ore	Foreign.
Mercury: Terlingua Mercury Corp	Presidio	do	Domestic.
Tin-Tungsten: Wah Chang Co: Texas City smelter.	Galveston	do	Foreign.
Zinc:			
American Smelting & Refining Co.:			
Amarillo retort smelter	Potter	Ore and concentrates.	Domestic and foreign.
Corpus Christi electrolytic	Nueces	do	Foreign.
El Paso fuming plant	El Paso	Dusts and residues	
American Zinc Co. of Illinois: Machovec smelter.	Moore	Concentrates and fumes.	Foreign and domestic.

Aluminum and Bauxite.—Bauxite ores from Surinam and the Dominican Republic were processed at the Point Comfort plant of Aluminum Company of America (Alcoa), and Jamaican bauxite was processed by Reynolds Metals Co. at its La Quinta plant. The alumina produced was reduced to metal at plants near Corpus Christi, Point Comfort, and Rockdale. Aluminum Company of America completed expansion of its Point Comfort plant with the addition of a seventh 20,000-ton-a-year potline. The company also reactivated two idle potlines, one at the Point Comfort works and the other at its Rockdale works. Production was begun in February at the first of four units of Alcoa's new 750,000-ton-a-year alumina plant adjacent to its Point Comfort reduction works. An estimated $45 million would be spent on the completed plant. When in full operation it would employ 600 people.

The dock and loading facilities at the La Quinta alumina plant of Reynolds Metals Co. were expanded at a cost of over $1 million. The new facilities included a 450-foot dock, a 270-foot electrically operated conveyor system, a 9,000-ton alumina storage silo, and a hopper-car unloading ramp that would permit loading alumina into tankers at the rate of 600 tons an hour.

Antimony.—Antimony ores from Mexico were treated under a Government contract at the Laredo smelter of National Lead Co.

Cadmium.—Cadmium was recovered as a byproduct from flue dust of other zinc smelters at the Corpus Christi smelter of American Smelting & Refining Co.

Copper.—The El Paso smelter of American Smelting & Refining Co. and the Nichols refinery of Phelps-Dodge Refining Co. were idled August 20 when wage negotiations between major copper, lead, and zinc producers and union workers ended in a stalemate. Both operations remained idle at yearend.

Ferroalloys.—Ferroalloys, including ferromanganese, were processed from foreign ores at the Houston plant of Tenn-Tex Alloy & Chemical Co.

Iron and Steel.—Open-pit production of iron ore was reported from four operations in three counties; output was nearly 13 percent greater than in 1958, although shipments were 7 percent less. The Houston works of Sheffield Division, Armco Steel Corp., one of the two integrated steelmills in Texas, was idled 134 days by a strike of steelworkers, which began July 14. Earlier in the year, the company began to produce high-strength alloy steel from new heat-treating facilities completed late in 1958. Lone Star Steel Co. became the first steel company in the United States to use natural gas on a continuous basis in a blast furnace. Use of gas was begun November 23, and the company reported that its use resulted in a substantial increase in pig iron production and a decrease in coke consumption. A $3 million, 35,000-ton-a-year, semi-integrated steel mill was planned for El Paso by Border Steel Rolling Mills. The mill would produce reinforcing bars, structural shapes, and other building-industry products from steel scrap for local and Mexican markets. East Texas, low-grade iron ore deposits were examined, sampled, and classified for mineral-dressing and metallurgical research.[3]

Lead.—Ores and concentrates from foreign countries were treated at the El Paso leadworks of American Smelting & Refining Co. Operations were stopped August 20 because of a labor dispute.

Magnesium.—Dow Chemical Co. recovered magnesium metal from sea water at its Freeport plant. Output was about the same as in

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[3] Brown, W. F., Sampling East Texas Iron Ores: Bureau of Mines Rept. of Investigations 5488, 1959, 32 pp.

1958, but stocks were reduced considerably as commercial and defense requirements increased. The company developed a process for applying porcelain enamel to magnesium. The magnesium industry concentrated research and development programs for casting and alloying and on improvement of commercial applications to reduce industry dependency on defense contracts.

Mercury.—A minor quantity of mercury was recovered from ores obtained in prospecting and development projects conducted in the Terlingua mining district.

Rare-Earth Metals.—American Lithium Chemicals, Inc., recovered cesium and rubidium from a mixed potassium-cesium-rubidium carbonate byproduct of lithium hydroxide production. A future potential use of cesium is as fuel in ion-propulsion motors for space travel. Rubidium appears to have potential as a heat-transfer fluid in nuclear engines.

Tin-Tungsten.—Tin and tungsten were recovered from foreign ores and concentrates at the Texas City smelter of Wah Chang Corp.

Uranium.—A 200-ton-a-day uranium mill was planned for the Falls City area by Susquehanna-Western, Inc. The proposed plant, estimated to cost around $2 million, would treat uranium ores recovered from open-pit deposits in Duval and Karnes Counties. Considerable quantities of uranium ore were being stockpiled near Falls City for the Atomic Energy Commission, and several truckloads were shipped to New Mexico mills for treatment and study.

Zinc.—Zinc retort facilities at Amarillo and Dumas and the electrolytic zinc plant at Corpus Christi were not affected by strikes in the nonferrous metal industry of 1959. The electrolytic zinc smelter at Corpus Christi of American Smelting & Refining Co. resumed full-scale production of 9,000 tons a month of special high-grade metal at mid-December after operating at 70 percent of capacity for nearly 2 years. The company's El Paso zinc fuming plant was idle for 4½ months because of a strike.

REVIEW BY COUNTIES

Anderson.—Mineral fuels were valued at $19.9 million, up 16 percent over 1958. Exploratory drilling resulted in discovery of the Slocum N.W./FB–2 Woodbine C oilfield. Crude oil was processed at the Tucker refinery of Anderson Refining Co. Tidewater Associated Oil Co. recovered natural-gas liquids at its Longlake cycling plant.

Andrews.—Andrews County was first in oil production and in value of minerals produced. Mineral production was valued at $215 million, 9 percent greater than in 1958. In 16 oilfields production exceeded 1 million barrels, and 13 new oilfields and new pays were discovered during the year. Gasoline plants of Phillips Petroleum, Pure Oil Co., and Pan-American Petroleum Corp. recovered natural-gas liquids. Sulfur was recovered from sour gas at the Andrews plant of Parker & Andrews Co.

Angelina.—Total mineral value increased 40 percent to $843,000 in 1959 as compared with 1958. Bentonitic clays were mined from open pits by Bennett-Clark Co., Inc., and Magnet Cove Barium Corp. Crushed sandstone was produced on contract for District 11 of the Texas Highway Department.

TABLE 22.—Value of mineral production in Texas, by counties[1]

County	1958[2]	1959	Minerals produced in 1959 in order of value
Anderson	$17,189,600	$19,884,700	Petroleum, natural gas, natural-gas liquids.
Andrews	196,814,500	214,983,800	Petroleum, natural-gas liquids, natural gas.
Angelina	602,965	842,843	Clays, stone, natural gas, petroleum.
Aransas	10,745,874	11,763,835	Petroleum, natural gas, natural-gas liquids, shell.
Archer	30,324,300	28,953,827	Petroleum, natural-gas liquids, stone, sand and gravel.
Atascosa	15,095,790	16,937,927	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Austin	6,845,429	5,362,041	Petroleum, natural gas, sand and gravel.
Bastrop	901,980	777,106	Clays, petroleum, natural gas.
Baylor	8,381,500	9,369,622	Petroleum, sand and gravel.
Bee	23,871,037	21,636,690	Natural gas, petroleum, natural-gas liquids, stone.
Bell	1,471,888	906,284	Sand and gravel, stone.
Bexar	16,304,063	19,888,186	Cement, stone, sand and gravel, petroleum, clays.
Blanco	6,561	23,896	Sand and gravel.
Borden	31,684,900	39,956,000	Petroleum, natural-gas liquids.
Bosque	23,333	76,775	Stone, sand and gravel.
Bowie	310,483	(3)	Sand and gravel, petroleum, natural gas.
Brazoria	167,384,677	149,265,799	Petroleum, natural gas, bromine, natural-gas liquids, magnesium chloride, salt, Frasch sulfur, magnesium compounds, lime, sand and gravel.
Brazos	28,900	41,900	Natural gas.
Brewster	43,538	63,124	Sand and gravel, clays, mercury, stone, gem stones.
Briscoe	33,089	(3)	Clays.
Brooks	18,564,500	14,709,700	Petroleum, natural gas.
Brown	2,149,050	2,030,790	Petroleum, natural gas, clays, sand and gravel.
Burleson	11,918	14,715	Sand and gravel, petroleum, natural gas.
Burnet	1,744,097	2,364,644	Stone, graphite, sand and gravel.
Caldwell	10,072,000	10,802,000	Petroleum.
Calhoun	17,356,821	18,097,349	Natural gas, petroleum, shell, lime, natural-gas liquids.
Callahan	8,282.700	7,465,000	Petroleum, natural gas.
Cameron	29,200	31,700	Do.
Camp	695,400	874,600	Petroleum.
Carson	24,794,900	37,028,900	Natural-gas liquids, petroleum.
Cass	10,186,788	8,306,477	Petroleum, natural-gas liquids, iron ore, natural gas.
Chambers	60,547,743	63,428,012	Petroleum, natural gas, shell, salt, natural-gas liquids.
Cherokee	8,238,189	8,712,390	Petroleum, iron ore, natural-gas liquids, natural gas, clays.
Childress	15,884	74,318	Sand and gravel.
Clay	17,751,114	17,130,337	Petroleum, natural-gas liquids, stone, natural gas.
Cochran	20,180,000	26,545,300	Petroleum, natural-gas liquids, natural gas.
Coke	30,591,650	24,397,200	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Coleman	10,776,017	12,619,928	Petroleum, natural gas, sand and gravel, natural-gas liquids, clays, stone.
Collin	----------	49,501	Stone.
Collingsworth	796,700	1,975,100	Petroleum.
Colorado	23,797,890	20,788,115	Natural gas, sand and gravel, natural-gas liquids, petroleum, stone.
Comal	(3)	3,222,126	Lime, stone, sand and gravel.
Comanche	435,719	454,770	Petroleum, stone, natural gas.
Concho	90,800	87,900	Petroleum, natural gas.
Cooke	25,587,308	33,340,439	Petroleum, natural-gas liquids, stone, sand and gravel, natural gas.
Coryell	45,797	106,271	Stone, sand and gravel.
Cottle	74,700	77,100	Sand and gravel, petroleum.
Crane	102,076,000	122,238,500	Petroleum, natural-gas liquids, natural gas.
Crockett	23,602,850	25,317,600	Petroleum, natural gas, natural-gas liquids.
Crosby	(3)	1,336,080	Sand and gravel, petroleum.
Culberson	589,150	4,056,975	Petroleum, stone, sand and gravel, gem stones.
Dallam	200,000	297,100	Natural gas.
Dallas	23,234,291	24,178,975	Cement, sand and gravel, stone, clays, gem stones.
Dawson	12,662,309	15,789,990	Petroleum, stone.
Denton	570,841	374,455	Petroleum, clays, sand and gravel.
De Witt	9,133,028	9,051,397	Petroleum, natural gas, sand and gravel, stone.
Dickens	160,421	262,845	Petroleum, stone, sand and gravel, pumice.
Dimmit	1,619,500	1,384,600	Petroleum, natural gas.
Donley	----------	117,120	Stone, sand and gravel.
Duval	41,343,379	44,480,404	Petroleum, natural gas, natural-gas liquids, salt.
Eastland	5,005,347	4.707,962	Petroleum, natural-gas liquids, natural gas, clays.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1958 [2]	1959	Minerals produced in 1959 in order of value
Ector	$205,269,480	$214,116,445	Petroleum, natural-gas liquids, cement, stone, sand and gravel, natural gas.
Edwards	3,400	20,900	Petroleum, stone.
Ellis	443,012	290,230	Clays, stone, sand and gravel.
El Paso	5,863,788	6,895,307	Cement, sand and gravel, stone.
Erath	196,483	351,933	Stone, natural gas, petroleum.
Falls	151,338	20,030	Petroleum, sand and gravel.
Fannin		(3)	Sand and gravel.
Fayette	1,303,307	1,288,216	Petroleum, sand and gravel, clays, gem stones, natural gas.
Fisher	17,938,771	17,014,530	Petroleum, gypsum, natural-gas liquids, sand and gravel.
Floyd	21,200	25,551	Sand and gravel, petroleum.
Foard	1,819,600	2,704,997	Petroleum, stone, natural gas, sand and gravel
Fort Bend	40,109,030	36,452,945	Petroleum, Frasch sulfur, natural gas, salt, clays, sand and gravel.
Franklin	12,828,500	13,799,300	Petroleum, natural gas.
Freestone	1,922,637	1,972,129	Petroleum, natural gas, sand and gravel, clays, stone.
Frio	6,758,300	6,067,600	Petroleum, natural gas.
Gaines	66,968,200	102,160,378	Petroleum, natural-gas liquids, natural gas, stone.
Galveston	31,804,032	30,239,292	Petroleum, natural gas, shell, natural-gas liquids, sand and gravel.
Garza	17,199,400	21,861,304	Petroleum, sand and gravel, uranium.
Gillespie	84,476	87,907	Sand and gravel, talc, stone.
Glasscock	10,219,600	561,800	Petroleum.
Goliad	14,274,500	10,918,800	Natural gas, petroleum.
Gonzales	337,093	306,238	Petroleum, clays, sand and gravel, stone.
Gray	59,616,900	61,478,700	Natural gas, petroleum, natural-gas liquids.
Grayson	25,748,769	21,182,330	Petroleum, stone, natural-gas liquids, natural gas, sand and gravel.
Gregg	118,797,200	107,536,200	Petroleum, natural-gas liquids, natural gas.
Grimes	112,900	20,800	Petroleum.
Guadalupe	13,197,348	11,210,799	Petroleum, sand and gravel, clays, natural gas.
Hale	5,449,400	6,348,200	Petroleum.
Hall	1,020		
Hamilton	388,275	230,184	Natural gas, sand and gravel.
Hansford	12,158,300	24,997,200	Natural gas, petroleum, natural-gas liquids.
Hardeman	(3)	(3)	Gypsum, petroleum.
Hardin	31,593,200	29,040,200	Petroleum, natural-gas liquids, natural gas.
Harris	107,553,632	103,016,941	Petroleum, cement, natural gas, natural-gas liquids, salt, lime, clays, shell, sand and gravel.
Harrison	26,568,389	24,419,884	Natural-gas liquids, petroleum, natural gas, lignite, clays.
Hartley	1,710,000	9,602,700	Petroleum.
Haskell	9,441,200	10,616,900	Do.
Hays	747,171	120,432	Sand and gravel.
Hemphill	93,600	376,900	Petroleum.
Henderson	2,023,086	6,785,749	Natural gas, natural-gas liquids, petroleum, sand and gravel, clays.
Hidalgo	11,316,861	28,315,512	Natural gas, petroleum, natural-gas liquids, sand and gravel, clays, stone.
Hill	15,420	155,840	Stone, sand and gravel, petroleum.
Hockley	40,558,300	39,553,200	Petroleum, natural-gas liquids, natural gas.
Hopkins	7,941,370	5,517,707	Petroleum, natural-gas liquids, clays.
Houston	2,274,800	1,907,800	Petroleum, natural gas.
Howard	45,448,100	41,937,800	Petroleum, sand and gravel.
Hudspeth	358,819	494,453	Talc, stone, gypsum, sand and gravel.
Hunt	(3)	32,900	Petroleum.
Hutchinson	55,260,955	62,556,835	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Irion	1,989,400	2,179,200	Petroleum, natural-gas liquids, natural gas.
Jack	20,332,505	14,651,344	Petroleum, natural gas, stone, natural-gas liquids.
Jackson	39,040,400	44,691,714	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jasper	1,527,450	2,942,800	Petroleum, natural gas, clays.
Jeff Davis	16,352	8,250	Sand and gravel.
Jefferson	43,097,980	52,674,727	Petroleum, natural gas, Frasch sulfur, natural-gas liquids, salt, sand and gravel, clays.
Jim Hogg	5,944,800	9,653,900	Petroleum, natural gas.
Jim Wells	61,192,200	71,744,500	Petroleum, natural gas, natural-gas liquids.
Johnson	1,151,996	1,273,001	Stone, lime, sand and gravel.
Jones	18,536,190	18,355,892	Petroleum, natural-gas liquids, sand and gravel, stone.
Karnes	10,025,391	9,388,944	Petroleum, natural-gas liquids, natural gas, uranium.
Kaufman	2,904,787	2,693,404	Petroleum, stone.
Kendall		18,472	Sand and gravel.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1958 [2]	1959	Minerals produced in 1959 in order of value
Kenedy	$1,259,200	$2,757,900	Natural gas, natural-gas liquids, petroleum.
Kent	12,941,477	36,006,800	Petroleum, sand and gravel.
Kerr	13,608	(3)	Sand and gravel.
Kimble	21,470	47,281	Sand and gravel, natural gas, petroleum.
King	3,275,700	2,288,700	Petroleum, natural gas.
Kleberg	12,111,766	19,894,644	Petroleum, natural gas, natural-gas liquids, stone.
Knox	6,111,100	9,755,500	Petroleum.
Lamb	1,999,200	1,826,600	Do.
Lampasas	196,026	77,046	Sand and gravel, stone.
La Salle	1,219,300	1,256,300	Petroleum, natural gas.
Lavaca	19,304,700	8,681,905	Natural gas, natural-gas liquids, petroleum, sand and gravel, stone.
Lee	7,100	13,724	Petroleum, sand and gravel, natural gas.
Leon	2,139,100	2,856,900	Natural gas, petroleum.
Liberty	54,614,160	50,641,570	Petroleum, Frasch sulfur, natural gas, sand and gravel, natural-gas liquids.
Limestone	2,164,055	1,813,047	Petroleum, stone, natural gas, clays.
Lipscomb	39,300	1,054,700	Petroleum, natural gas.
Live Oak	13,341,450	13,645,322	Natural gas, petroleum, sand and gravel, gem stones.
Llano	987,092	951,454	Stone, feldspar, gem stones.
Loving	5,239,700	7,128,000	Petroleum, natural gas.
Lubbock	2,320,590	1,558,110	Petroleum, sand and gravel.
Lynn	916,500	1,494,900	Petroleum.
Madison	1,103,500	1,062,800	Natural gas, petroleum.
Marion	7,477,000	7,562,600	Petroleum, natural gas, natural-gas liquids.
Martin	1,937,100	3,046,800	Petroleum.
Mason	46,936	33,159	Sand and gravel, gem stones.
Matagorda	35,780,614	29,398,424	Petroleum, natural gas, natural-gas liquids, shell, clays, sand and gravel.
Maverick	151,000	340,300	Petroleum, natural gas.
McCulloch	118,856	322,565	Sand and gravel, stone, petroleum.
McLennan	4,016,316	4,732,854	Cement, sand, and gravel, stone, clays, petroleum.
McMullen	9,011,500	8,038,100	Natural gas, petroleum.
Medina	507,700	700,260	Petroleum, clays, natural gas.
Menard	--------	6,600	Natural gas.
Midland	55,623,600	38,110,600	Petroleum, natural-gas liquids, natural gas.
Milam	3,761,302	(3)	Lignite, petroleum, natural gas.
Mills	11,770	--------	
Mitchell	8,121,606	6,016,378	Petroleum, sand and gravel.
Montague	22,461,687	19,812,557	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Montgomery	31,892,211	29,854,591	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Moore	36,707,106	40,800,953	Natural-gas liquids, helium, petroleum.
Morris	(3)	(3)	Iron ore, sand and gravel.
Motley	410,135	968,372	Petroleum, sand and gravel.
Nacogdoches	1,581,730	2,856,347	Natural gas, clays.
Navarro	6,765,881	6,454,460	Petroleum, sand and gravel, natural gas, clays, stone.
Newton	5,553,400	4,172,800	Petroleum, natural gas.
Nolan	34,447,638	38,800,620	Petroleum, natural-gas liquids, cement, gypsum, stone, natural gas, sand and gravel, clays.
Nueces	79,222,143	80,594,677	Natural gas, petroleum, natural-gas liquids, cement, lime, shell, sand and gravel, clays.
Ochiltree	6,566,600	14,926,600	Petroleum, natural gas, natural-gas liquids.
Oldham	(3)	(3)	Sand and gravel, petroleum.
Orange	18,753,494	14,220,459	Petroleum, natural gas, cement, natural-gas liquids, clays.
Palo Pinto	1,427,711	2,291,335	Petroleum, natural-gas liquids, natural gas, clays, stone, sand and gravel.
Panola	78,808,000	59,501,600	Natural gas, natural-gas liquids, petroleum.
Parker	1,181,125	2,361,291	Natural-gas liquids, natural gas, stone, clays, petroleum.
Pecos	45,027,200	61,801,124	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, gem stones.
Polk	5,036,444	5,213,335	Petroleum, natural gas, sand and gravel.
Potter	6,535,916	12,671,612	Sand and gravel, helium, natural-gas liquids, stone.
Presidio	15,258	4,500	Stone.
Reagan	33,341,320	36,347,200	Petroleum, natural-gas liquids, natural gas.
Red River	41,400	84,600	Petroleum.
Reeves	2,546,900	5,841,938	Petroleum, natural-gas liquids, natural gas, sand and gravel, gem stones.
Refugio	63,422,600	64,869,700	Petroleum, natural gas, natural-gas liquids.
Roberts	4,188,300	5,414,100	Petroleum, natural gas.
Robertson	688,938	433,152	Sand and gravel, petroleum, natural gas.
Runnels	15,732,113	23,565,949	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Rusk	75,524,937	65,252,638	Petroleum, natural-gas liquids, natural gas, clays.

See footnotes at end of table.

TABLE 22.—Value of mineral production in Texas, by counties [1]—Continued

County	1958 [2]	1959	Minerals produced in 1959 in order of value
Sabine	$2,000	-------------	
San Augustine	-------------	$12,134	Stone.
San Jacinto	2,487,640	1,589,225	Petroleum, natural gas, sand and gravel.
San Patricio	44,887,606	49,698,079	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Schleicher	8,145,000	10,802,000	Petroleum, natural-gas liquids, natural gas.
Scurry	124,691,550	119,095,125	Petroleum, natural-gas liquids, clays.
Shackelford	10,648,300	10,441,200	Petroleum, natural gas, natural-gas liquids.
Shelby	2,052,500	1,414,700	Natural gas, petroleum.
Sherman	6,114,500	7,791,100	Do.
Smith	9,087,715	11,570,843	Petroleum, natural gas, natural-gas liquids, clays, sand and gravel.
Starr	21,487,768	23,049,430	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, clays.
Stephens	27,396,450	10,114,784	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Sterling	1,639,108	1,977,200	Petroleum.
Stonewall	24,868,850	23,288,047	Petroleum, natural-gas liquids, sand and gravel.
Sutton	309,300	1,221,300	Natural gas, petroleum.
Tarrant	12,102,191	12,681,049	Cement, sand and gravel, stone.
Taylor	11,611,417	15,123,850	Petroleum, stone, sand and gravel, clays, natural gas.
Terrell	-------------	67,900	Natural gas.
Terry	18,974,413	13,120,065	Petroleum, natural salines, natural gas liquids, sand and gravel.
Throckmorton	12,249,700	11,862,749	Petroleum, sand and gravel, natural gas.
Titus	9,432,800	9,054,300	Petroleum.
Tom Green	6,128,965	5,132,392	Petroleum, sand and gravel, natural gas.
Travis	5,669,281	3,125,289	Stone, lime, sand and gravel, petroleum, abrasive stone.
Trinity	215,889	4,174,797	Petroleum, natural gas, stone.
Tyler	3,047,500	-------------	
Upshur	6,677,900	6,135,130	Petroleum, sand and gravel.
Upton	53,903,500	50,613,700	Petroleum, natural-gas liquids, natural gas.
Uvalde	(3)	3,295,140	Asphalt, basalt, sand and gravel, natural gas.
Val Verde	-------------	725,564	Natural gas, sand and gravel, petroleum.
Van Zandt	23,887,519	22,948,306	Petroleum, salt, natural-gas liquids, natural gas.
Victoria	31,583,534	20,721,006	Petroleum, natural gas, sand and gravel, stone.
Walker	179,056	196,044	Clays, petroleum.
Waller	27,106,794	37,944,992	Natural gas, natural-gas liquids, sand and gravel, petroleum.
Ward	51,669,077	68,953,711	Petroleum, natural-gas liquids, natural gas, sand and gravel, natural salines.
Washington	649,700	587,200	Petroleum, natural gas.
Webb	4,483,462	6,308,907	Petroleum, natural gas, stone, sand and gravel, clays.
Wharton	60,618,818	62,050,031	Frasch sulfur, petroleum, natural gas, natural-gas liquids, sand and gravel.
Wheeler	6,516,600	8,821,300	Natural gas, petroleum, natural-gas liquids.
Wichita	37,487,170	33,347,302	Petroleum, natural-gas liquids, sand and gravel, stone, natural gas.
Wilbarger	19,628,660	18,161,611	Petroleum, sand and gravel.
Willacy	6,540,600	6,010,600	Petroleum, natural gas.
Williamson	1,816,433	2,563,909	Stone, lime, petroleum.
Wilson	2,761,082	1,956,973	Petroleum, clays, natural gas.
Winkler	66,733,500	79,822,700	Petroleum, natural gas, natural-gas liquids.
Wise	17,448,661	26,450,004	Petroleum, natural gas, natural-gas liquids, stone, clays.
Wood	52,116,200	50,937,200	Petroleum, natural-gas liquids, natural gas.
Yoakum	52,082,085	38,938,040	Petroleum, natural-gas liquids, salt.
Young	21,625,306	19,946,123	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone.
Zapata	2,237,133	2,438,700	Petroleum, natural gas.
Zavala	481,200	793,500	Do.
Undistributed	15,326,026	17,938,201	
Total	4,033,311,000	4,201,203,000	

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[1] The following counties are not listed because no production was reported: Armstrong, Bailey, Bandera, Castro, Deaf Smith, Delta, Hood, Kinney, Lamar, Parmer, Rains, Randall, Real, Rockwall, San Saba, Somervell, and Swisher.

[2] Revised figures.

[3] Figure withheld to avoid disclosing individual company data: included with "Undistributed."

Aransas.—Mineral output was valued at $11.8 million, an increase of 9 percent over 1958. Bay Petroleum Corp. built a natural-gasoline plant on Copano Bay to process 15 million cubic feet of natural gas daily in recovering 32,000 to 42,000 gallons of liquids. Shell was dredged from Nueces Bay by two producers. Carbon black was recovered from natural gas and natural-gas liquids at Kosmos A and B plants of United Carbon Co., Inc. Bay Petroleum Corp. recovered natural-gas liquids at its K. G. Pearce gasoline plant.

Archer.—The value of minerals produced declined 4 percent in 1959 to $28.9 million. Exploratory drilling accounted for 15 new oilfields and new pays. Two oilfields, Archer County Regular and Hull-Silk-Sikes, produced in excess of 1 million barrels each. Warren Petroleum Corp. recovered natural-gas liquids at its Holiday gasoline plant. Crushed sandstone, limestone, and sand and gravel were produced on contract for District 3 of the Texas Highway Department.

Atascosa.—The value of minerals produced amounted to $16.9 million, 12 percent more than in 1958. Discovery of the Renshaw-Carrizo oilfield was reported during the year. Natural-gas liquids were recovered at the Jourdanton gasoline plant of Humble Oil & Refining Co. and the Pleasanton cycle plant of Lone Star Producing Co. Sand and gravel was produced by Espey Silica Sand Co. and West-Land Silica Co.

Austin.—The value of mineral production declined 22 percent, compared with 1958. Building and paving sand and gravel were produced on contract for District 12 of the Texas Highway Department and by Brazos River Sand & Gravel.

Bastrop.—Mineral production declined 14 percent, compared with 1958. Fire clay was mined from open pits by Elgin-Butler Brick Co., Elgin Standard Brick Manufacturing Co., and Payne Brick Co. for use in the manufacture of brick and tile. Crude oil and natural gas were also produced. Exploratory drilling by the oil industry resulted in the discovery of the Paige/Buda oilfield.

Baylor.—The value of minerals produced increased 12 percent to $9.4 million. Three oilfields were discovered through exploratory drilling. District 3 of the Texas Highway Department contracted for paving sand and gravel.

Bee.—Mineral fuels (including a small amount of stone) produced in Bee County in 1959 were valued at $21.6 million, 9 percent less than the 1958 value. Natural-gas liquids were recovered at the Burnell and North Pettus cycling plants of Pan American Petroleum Corp. Danaho Refining Co. processed crude oil at its Pettus refinery. Crushed limestone (caliche) for concrete aggregate and for roadstone was produced by Heldenfels Brothers.

Bell.—The value of crushed limestone and sand and gravel produced in the county was 38 percent less than in 1958. Paving gravel and crushed limestone for concrete aggregate and roadstone were produced on contract for District 9 of the Texas Highway Department. Building sand and gravel was produced by Belton Sand-Gravel Co., Inc., and Little River Gravel Co.

Bexar.—Output of minerals was 22 percent greater in value than in 1958. Portland and masonry cements were produced by Longhorn Portland Cement Co. and San Antonio Portland Cement Co. Ten sand and gravel producers produced 1.7 million tons, valued at $1.9 million. Fire clay and miscellaneous clay totaling 131,000 tons were mined from open pits by Alamo Clay Products Co., Barrett Industries, Featherlight Co. of San Antonio, and The Southern Co. Major uses for clay included brick, heavy clay products, and lightweight aggregate. Crushed limestone for aggregate in concrete, for roadstone, riprap, and railroad ballast was quarried by four producers; two cement producers quarried and crushed limestone for use in the manufacture of portland cement. Lithium hydroxide and other lithium compounds were processed from lepidolite ores of South Africa at the San Antonio plant of American Lithium Chemicals, Inc. Crude oil was processed at the Somerset refinery of Monarch Refining Co., the San Antonio refineries of Howell Refining Co., Inc., and Texas American Asphalt Co.

Borden.—The value of mineral fuels produced was $40 million, 26 percent greater than 1958. Exploratory drilling resulted in discovery of eight new oilfields and oil pays. Four oilfields in the county produced more than 1 million barrels each.

Bowie.—Mineral value increased appreciably over 1958. Building and paving sand and gravel were produced by Gifford-Hill & Co., Inc. Crude oil and natural gas were also produced in the county.

Brazoria.—The value of minerals produced declined 11 percent to $149.3 million. The county was the third highest in total mineral value and in natural gas production. Three oilfields were discovered. Five oilfields in the county produced more than 1 million barrels each. Gasoline plants of Humble Oil & Refining Co., Pan American Petroleum Corp., and Phillips Petroleum Co. recovered natural-gas liquids. Crude oil was processed at the Sweeney refinery of Phillips Petroleum Co. Carbon black was recovered from natural gas at the Sweeney No. 204 Roller plant of Columbian Carbon Co. Lime was produced from shell by Dow Chemical Co. for manufacturing magnesium compounds, including magnesium chloride used in the production of metal, at its large Freeport chemical and magnesium reduction works. Bromine was recovered from sea water by Ethyl-Dow Chemical Co. for manufacturing ethylene dibromide. Sulfur was recovered by the Frasch process from the Clements Dome by Jefferson Lake Sulphur Co. and the Hoskins Mound Dome by Freeport Sulphur Co. Salt in brine was recovered from wells by Dow Chemical Co. for manufacturing organic and inorganic chemicals. Paving sand and gravel was produced by contractors for District 12 of the Texas Highway Department.

Brewster.—Total mineral value was 45 percent greater than in 1958. Carbonaceous earths were recovered from open pits by the Manning Minerals Corp. and Soylaid, Inc. Mercury was recovered from development ore by Lone Star Mercury, Inc. Paving sand and gravel and crushed limestone were produced by contractors for District 24 of the Texas Highway Departments.

Briscoe.—Silverton Clay Products Co. recovered fuller's earth from open pits for use as a filtering medium, for oil refining, and for decolorizing oils.

Brooks.—The value of minerals produced declined 21 percent to $14.7 million, compared with 1958. Five new oilfields and oil pays were discovered. United Carbon Co., Inc., recovered carbon black from natural gas at its Dixie channel plant.

Brown.—The value of minerals produced was 6 percent less than in 1958. The Brownwood Concrete Co. processed 30,668 tons of building sand and gravel. Miscellaneous clays for manufacturing brick and heavy clay products were mined from open pits by Texas Brick Co. Crude oil and natural gas were produced during the year.

Burleson.—The value of crude oil, natural gas, sand and gravel production was 23 percent greater than in 1958. The Gulf, Colorado, and Santa Fe Railway Co. produced 25,347 tons of sand for railroad ballast.

Burnet.—The value of minerals produced was 36 percent greater than in 1958, amounting to $2.4 million. Southwestern Graphite Co. mined graphite from open pits and processed the material at its Burnet mill. Crushed granite for riprap and other uses was quarried and crushed by Texas Crushed Stone Co. and Texas Granite Corp. Dimension granite for dressed architectural and monumental stone, rough monumental stone, and paving block, was quarried and prepared by Texas Crushed Stone Co. and Texas Granite Corp. Gravel was prepared for use as paving by Texas Crushed Stone Co.

Caldwell.—The value of crude oil production was 7 percent greater than in 1958.

Calhoun.—There was a 4-percent increase to $18.1 million in the value of minerals produced as compared with 1958. Nine oilfields and oil pays were discovered by exploratory drilling. Natural-gas liquids were recovered at the Hyser gasoline plant of Humble Oil & Refining Co. and Point Comfort gasoline plant of Aluminum Company of America. Alcoa company manufactured lime from shell for use in its new alumina plant. Shell was dredged from shallow bays of Calhoun County by Bauer-Smith Dredging Co. and Smith Brothers Dredging Co. The Point Comfort aluminum plant of Alcoa processed Surinam and Dominican Republic bauxite ores to recover alumina; this material was then further processed to aluminum pigs and ingots at the reduction works. The first unit of the new 750,000-ton-a-year alumina plant began production in February, a second unit was completed in December with the final two sections scheduled for production in 1960. A multimillion dollar expansion of the Seadrift facilities of Union Carbide Chemicals Co. increased output of esters and industrial alcohols by 100 million pounds annually. A new unit also produced 85 million pounds of high-pressure polyethylene annually. The Seadrift facilities also produced ethylene oxide, glycols, and polyethylene resins.

Callahan.—The value of crude oil and natural gas was $7.5 million, 10 percent less than in 1958. Exploratory drilling resulted in discovery of the H & H Cook oilfield.

Cameron.—Crude oil and natural gas output was 9 percent greater in value than in 1958. Barite imported from foreign sources was processed for heavy drilling muds by Magcobar, Inc. Union Carbide Chemical Co., which acquired the Carthage hydrocol plant late in 1958, converted the plant to produce a variety of solvents and intermediates for use in the pharmaceutical and textile industries.

Camp.—Crude oil output, valued at $875,000, was 26 percent greater than the 1958 production.

Carson.—Carson County continued to be an important producer of crude oil and natural-gas liquids with output valued at $37 million, 49 percent greater than the 1958 value. Carbon black was recovered at the Schoeber channel plant of Cabot Carbon Co. Gasoline plants of the Dorchester Corp., Shell Oil Co., and Skelly Oil Co. recovered natural-gas liquids.

Cass.—Mineral production declined 18 percent to $8.3 million in comparison with 1958. Six new oilfields and oil pays were discovered. The Kildare oilfield produced more than 1 million barrels of crude. S. E. Evans Mining Co. produced iron ore from open pits under contract with the Sheffield Division of Armco Steel Co.

Chambers.—Total mineral value was $63.4 million, 5 percent greater than in 1958. Exploratory drilling resulted in discovery of 10 new oilfields and oil pays. The county had three oilfields producing in excess of 1 million barrels of crude oil each. Humble Oil & Refining Co. recovered natural-gas liquids at its Anahuac gasoline plant. Salt in brine was obtained from salt domes near Barbers Hill by Diamond Alkali Co. for manufacturing industrial chemicals. W. D. Haden and Parker Brothers & Co., Inc. recovered nearly 4 million tons of shell for use as aggregate in concrete, in manufacture of paper and magnesium metal, as poultry grit, and as filler. Aztec Brick Co. was building a 4-kiln, 40,000-brick-a-day plant near Mont Belvieu.

Cherokee.—The value of mineral production amounted to $8.7 million, 6 percent greater than 1958. The East Texas oilfield, with cumulative production of 3.4 billion barrels of crude oil, was the largest producing oilfield in the State and Nation in 1959. The Neches gasoline plant of Humble Oil & Refining Co. recovered natural-gas liquids. L. D. Haberle Mining Corp. and Sheffield Division of Armco Steel Corp. mined iron ore from open pits. Fire clay was recovered from open pits by General Refractories Co. for use in the manufacture of fire brick and refractory shapes.

Clay.—Mineral production declined 4 percent in value, although seven new oilfields were discovered through exploratory drilling. Otha H. Grimes recovered natural-gas liquids at his Ringgold gasoline plant. Crushed limestone was quarried and prepared on contract for District 3 of the Texas Highway Department for use as aggregate and roadstone.

Cochran.—Total mineral value was $26.5 million, 32 percent greater than in 1958. The Slaughter and Levelland oilfields each produced more than 1 million barrels of crude petroleum. The Lehman gasoline plant of Cities Service Oil Co. recovered natural-gas liquids from the Levelland gasfield.

Coke.—The value of minerals produced was $24.4 million, 20 percent less than that of 1958. Exploratory well drilling resulted in discovery of the Leppart/Palo Pinto and the Panther Gap/Penn. Reef oilfields. The Jameson and the Jameson/Strawn oilfields each produced more than 1 million barrels of crude. Natural-gas liquids were recovered at the Perkins gasoline plant of Texas Hydrocarbon Co. and the Jameson plant of Sun Oil Co. Building and paving sand and gravel were produced by Montgomery Sand & Gravel Co.

Coleman.—A 17 percent increase in mineral value to $12.6 million was reported and four new oil fields and oil pays were discovered. The Coleman County Regular oilfield produced over 1 million barrels of crude. Martin Brick Co. mined miscellaneous clay from open pits for manufacturing heavy clay products. Quality glass and molding sands were prepared by Santa Anna Silica Sand Co., Inc. Crushed limestone was quarried and prepared for aggregate in concrete and roadstone by T. E. Sanderford.

Collingsworth.—Production of mineral fuels—crude oil, and natural gas—increased appreciably over 1958.

Colorado.—The value of mineral output was $20.8 million, 13 percent less than in 1958. A total of seven new oilfields and oil pays were discovered. Natural-gas liquids were recovered at the Sheridan cycling plant of Shell Oil Co. and the Chesterville gasoline plant of Tennessee Gas Transmission Co. A total of 3.3 million tons of building and paving sand and gravel was produced by Horton & Horton, Inc., Parker Bros. & Co., Inc., and Texas Construction Materials Co.; in addition, 180,000 tons of paving sand and gravel were produced by contractors for District 13 of the Texas Highway Department. Crushed sandstone was quarried and prepared on contract for District 13 of the Texas Highway Department for use as aggregate in concrete and as roadstone.

Comal.—The value of minerals produced was 8 percent greater than in 1958. Lime was produced from limestone quarried and prepared by United States Gypsum Co. Production of crushed limestone was reported by Servtex Materials Co. Building and paving sand and gravel were prepared by Erhardt Kraft.

Comanche.—Mineral production was valued at 4 percent more than in 1958. Limestone was crushed and prepared for road construction in District 23 of the Texas Highway Department. Crude oil and natural gas were produced during the year. The Bibb, West/Marble Falls oilfield was discovered.

Concho.—The value of crude oil and natural gas production was 3 percent less than in 1958.

Cooke.—Mineral production was valued at $33.3 million, 30 percent more than in 1958. Exploratory drilling resulted in discovery of 10 new oilfields and oil pays. The Cooke County Regular and the Gatewood oilfield each produced more than 1 million barrels of crude oil. The Walnut Bend gasoline plant of Texas Natural Gasoline Corp. and the Sivells Bend gasoline plant of Standard Oil Co. of Texas recovered natural-gas liquids. The Tydal Co. processed crude oil at its Gainesville refinery. Paving sand and gravel and crushed limestone were produced on contract for District 3 of the Texas Highway Department.

Coryell.—The combined value of stone and sand and gravel was 132 percent greater than in 1958. Crushed limestone and paving sand and gravel for concrete aggregate and roadstone were quarried and prepared on contract for District 9 of the Texas Highway Department. Dressed building limestone was quarried and prepared by Mid-Tex Stone Co.

Cottle.—Mineral value was 3 percent greater than in 1958. Building and paving sand and gravel were prepared by Childress Sand & Gravel Co. Crude oil also was produced.

Crane.—The combined value of crude oil, natural gas, and natural-gas liquids amounted to $122.2 million, 20 percent greater than in 1958. Four new oilfields were discovered and eight oilfields in the county each produced more than 1 million barrels of crude. The county was fourth in total mineral value and third in oil production. Gasoline plants of Warren Petroleum Corp., Phillips Petroleum Co., Natural Gas Products Co. of America, and Houston Hydrocarbon Corp. recovered natural-gas liquids. Sulfur was recovered from sour natural gas at the Crane plant of Phillips Chemical Co. and the Waddell plant of Warren Petroleum Corp.

Crockett.—The value of mineral output increased 7 percent, to $25.3 million, over 1958. Continental Oil Co. recovered natural-gas liquids at its Todd Ranch gasoline plant. Exploratory drilling accounted for six new oilfields. The World oilfield produced more than 1 million barrels of crude.

Crosby.—The value of minerals produced was 17 percent greater than in 1958. Exploratory drilling discovered the Ridge, South/Clearfork oilfield. Building and paving sand and gravel were prepared by Janes-Prentice, Inc.

Culberson.—The value of mineral production increased nearly 600 percent to $4.1 million because of the large increase of oil production from the Geraldine-Ford oilfield. This field produced more than 1 million barrels of crude oil in 1959. One new oilfield, the Eitherway/Delaware, was discovered. Crushed limestone was quarried and paving gravel was prepared on contract for District 24 of the Texas Highway Department. They were used for roadstone and as aggregate in concrete. A quantity of gem-quality agate was reported from the county.

Dallam.—The value of natural gas was 49 percent greater than in 1958.

Dallas.—There was a 4-percent increase in the value of minerals produced compared with 1958. Portland and masonry cements were prepared by Lone Star Cement Corp. at Cement City and by Trinity Portland Cement Division of General Portland Cement Co. at Eagle Ford; both companies quarried and crushed limestone for manufacturing cement. Crushed limestone also was prepared by Southwest Industrial Materials Corp. A total of 4.8 million tons of sand and gravel was prepared at 24 plants by 19 producers. Contractors produced paving sand and gravel for District 18 of the Texas Highway Department. A $150,000 expansion and modernization program by River Bend Production Co. increased its Seagoville sand and gravel output to 200 cubic yards an hour. Crude perlite and crude vermiculite produced in other states were processed at the Irving plant of Texas Lightweight Products Co. and at the Dallas plant of Texas Vermiculite Co. for use as lightweight aggregate for concrete, for roof decks, and for building plaster. Miscellaneous clay was mined from open pits by Ferris Brick Co. for use in manufacturing building brick and heavy clay products and by Dallas Lightweight Aggregate Co. for making lightweight aggregate. Surface clays were recovered by Lone Star Cement Corp. and General Portland Cement Co. for manufacturing cement. The crude-oil capacity of the Irving refinery of Great Western Producers, Inc. was raised from 1,800 to 2,600 barrels daily, and the catalytic re-forming capacity was increased from 1,200 to 1,500 barrels daily. A $50,000 pilot plant and laboratory was built at Duncanville by Debco Chemical Co. as a nucleus of a planned multimillion dollar plaster manufacturing plant.

Dawson.—Total mineral value was $15.8 million, 25 percent greater than in 1958. Exploratory drilling resulted in four new oilfields. The Welch oilfield produced more than 1 million barrels of crude. Crushed limestone for concrete aggregate and roadstone was quarried and prepared by Lone Star Materials, Inc.

Denton.—The mineral production decreased 34 percent in value, compared with 1958. Fire clay used in the manufacture of brick and heavy clay products was mined from open pits by Acme Brick Co. Paving gravel was prepared by contractors for District 18 of the Texas Highway Department.

DeWitt.—Mineral value approximated that of 1958. Three new oilfields were discovered. District 13 of the Texas Highway Department quarried and crushed limestone for concrete aggregate and roadstone and sand and gravel for paving purposes.

Dickens.—There was a 64-percent increase in the value of minerals produced, compared with 1958. Limestone was quarried and prepared for concrete aggregate and roadstone for District 25 of the Texas Highway Department. Building and paving gravel was prepared by R. W. Mize. Pumicite was mined from open pits and prepared as an oil and grease absorbent by Caprock Chemical Co.

Dimmit.—The combined mineral value of crude oil and natural gas was 15 percent less than in 1958 and seven new fields were discovered through exploratory drilling. Crude oil was processed at the Carrizo Springs refinery of Texas Oil Co.

Donley.—Limestone was quarried and crushed for District 25 of the Texas Highway Department. Contractors prepared paving gravel for District 25 of the Texas Highway Department.

Duval.—The value of mineral output amounted to $44.5 million, 8 percent greater than in 1958. Twenty-one new oilfields were discovered during the year and added to the county's crude oil reserve. The Hoffman oilfield produced more than 1 million barrels of crude. The Sejita cycling plant of Trinity Gas Corp. and the Hagist gasoline plant of Goliad Corp. recovered natural-gas liquids. Salt in brine was recovered from wells near San Diego by Columbia Southern Chemical Corp. for use in manufacturing industrial chemicals at its Corpus Christi plant.

Eastland.—Mineral value declined 6 percent to $4.7 million, compared with 1958. Gasoline plants of Mobil Oil Co., Grayridge Corp., Lone Star Gas Co., and Lone Star Producing Co. recovered natural-gas liquids. Fire and miscellaneous clays were recovered from open pits for making lightweight aggregate by American Aggregate Co. and Texas Lightweight Aggregate Co., and for heavy clay products and brick by N. D. Gallagher Clay Products Corp. and Texeramics, Inc. Two new kilns added to the Ranger lightweight aggregate plant of American Aggregate Co. doubled its capacity.

Ector.—The total value of minerals produced amounted to $214.1 million, 4 percent greater than in 1958. The county ranked second in total value of mineral production and in crude oil production. There were 10 new oilfields or new oil pays discovered in the county during the year. A total of 14 oilfields produced in excess of 1 million barrels of crude ore each. Gasoline plants of Odessa Natural Gasoline Co., Phillips Petroleum Co., Shell Oil Co., Pan American Petroleum and Texas Gulf Producing Co. recovered natural-gas liquids. Sulfur was recovered from sour gas at the Odessa plants of California-Spray Chemical Corp. and Odessa Natural Gasoline Co., the Penwell plant of J. L. Parker, and the Goldsmith plants of Pan American Petroleum Corp. and Phillips Chemical Co. The Sid W. Richardson Carbon Co. recovered carbon black from natural gas at its channel plant. Limestone and clay were mined from open pits by Southwestern Portland Cement Co. for portland and masonry cements. The company began cement production at its new 1.25-million-barrel-a-year plant southwest of Odessa. Crushed limestone for concrete aggregate and roadstone was quarried and prepared by Permian Sand & Gravel Co. and F. M. Reeves & Sons, Inc. Building and paving sand and gravel were prepared by F. M. Reeves & Sons, Inc.

Edwards.—Crushed limestone was quarried and prepared on contract for District 22 of the Texas Highway Department. The value of mineral production was greater than in 1958 owing to increased crude oil output.

Ellis.—The value of mineral production dropped 34 percent. Miscellaneous clay was mined from open pits near Palmer by Barron Brick Co. and Acme Brick Co. and from pits near Ferris by the Ferris Brick Co. The clay was used for making building and face brick, drain and sewer tile, sewer pipe, and kindred products. Limestone was quarried and prepared by contractors for District 18 of the Texas Highway Department. Paving gravel was prepared by Texas Bitulithic Co.

El Paso.—Mineral production increased 18 percent compared with 1958. Southwestern Portland Cement Co. quarried limestone and shale from open pits for use in manufacture of portland and masonry cements at its El Paso works. The lead and copper smelters of American Smelting & Refining Co. and the Nichols copper refinery of Phelps-Dodge Refining Co. were closed by an extended labor strike during the last half of the year. El Paso refineries of Standard Oil Co. of Texas and Texaco, Inc. processed crude oil. Texaco, Inc., added a 1,600-barrel alkylation unit to its refinery. A $3 million, 36,000-ton-a-year steel mill was planned for El Paso by Border Steel Co. El Paso Electric Co. spent $11 million on new electric generating facilities and expansion to its transmission and distribution systems in the El Paso area. Dura-Bond Gypsum Co. completed a $700,000 gypsum wallboard plant near El Paso. Crude gypsum was procured from company operations in New Mexico. Limestone was quarried and crushed for concrete aggregate and roadstone by McMillan Quarries, Inc., and Vowell Material Co. Sandstone was quarried and crushed for riprap, concrete aggregate, and roadstone by Standard

Aggregates Co. Building sand and gravel was prepared by El Paso Sand & Gravel Products Co. and structural and paving sand and gravel was prepared on contract for the U.S. Corps of Engineers.

Erath.—The value of mineral output was 79 percent greater than in 1958. Limestone was quarried and crushed for District 2 of the Texas Highway Department. Crude oil and natural gas were reported from the county during the year.

Falls.—Crude oil and sand and gravel were produced. Paving sand and gravel was produced by contractors for the highway program of District 9 of the Texas Highway Department.

Fannin.—Building and paving sand and gravel were prepared by Wray Wible. A multimillion dollar electric generating plant with a capacity of 125,000 kilowatts was planned 2 miles north of Savoy by Texas Power & Light Co.

Fayette.—The value of minerals produced was slightly less than that in 1958. Bentonitic clays and fuller's earth were mined from open pits by Milwhite Co., Inc., Baroid Division of National Lead Co., and Flatonia Fullers Earth Co. Building and paving sand and gravel were produced by Thorstenberg Materials Co. and by contractors for District 13 of the Texas Highway Department.

Fisher.—There was a 5-percent decrease in total mineral value to $17 million. Two oilfields, Carriker/Canyon Sand and Frankus/Strawn Reef, were discovered during the year. Natural-gas liquids were recovered at the Claytonville and "F" gasoline plants of Claytonville Gasoline Co. and at the Velta plant of Texas Pacific Coal & Oil Co. Gypsum was mined from open pits near Longworth by the Celotex Corp. and from pits near Rotan by National Gypsum Co. National Gypsum Co. planned expansion of its Rotan units producing gypsum, wallboard, lath, plaster, and other building products. Building sand and gravel was prepared by Ashton Gravel Co.

Floyd.—Crude oil and natural gas output increased 21 percent over 1958. Paving sand and building and paving gravel were prepared by Quitaque Sand & Gravel Co.

Foard.—Mineral value increased 49 percent to $2.7 million compared with 1958. The Crowell, North/Des Moines oilfield was discovered. Limestone was quarried and crushed for use as concrete aggregate and roadstone for District 25 of the Texas Highway Department. Paving sand was produced by contractors for District 25.

Fort Bend.—The value of minerals produced was $36.4 million, 9 percent less than in 1958. The Needville, South/6700 Frio and the Needville, South/7000 Frio oilfields were discovered. The Thompson oilfield produced more than 1 million barrels of crude oil during the year. Paving sand and gravel was produced by contractors for District 12 of the Texas Highway Department. Miscellaneous clay was mined from pits near Missouri City by the Texas Lightweight Aggregate Co. and used in lightweight aggregate. Evaporated and block salt was prepared from brine at the Blue Ridge works of the United Salt Corp. Sulfur was recovered by the Frasch process at the Orchard Dome by Duval Sulphur and Potash Co. and at the Long Point Dome by Jefferson Lake Sulfur Co. Freeport Sulphur Co. maintained cleanup operations at its Nash facilities.

Franklin.—Crude oil and natural gas production was valued at $13.8 million, 8 percent more than 1958. Two oilfields, the Talco and the New Hope/Bacon Lime, each produced in excess of 1 million barrels.

Freestone.—Mineral value was 3 percent more than in 1958. The Graddy/Woodbine oilfield was the only oil discovery in 1959. Ballast gravel was prepared for the Rock Island and Pacific railroads. Sandstone was quarried and crushed by contractors for aggregate and roadstone for District 18 of the Texas Highway Department. Miscellaneous clay was mined from open pits for use in the manufacture of brick and heavy clay products by the Teague Brick & Tile Co.

Frio.—The value of crude oil and natural gas produced in Frio County amounted to $6.1 million, 10 percent less than in 1958. Exploratory drilling resulted in discovery of the Corn/Olmos, D–2 oilfield. The Big Foot oilfield produced more than 1 million barrels of crude oil.

Gaines.—Total mineral value increased 53 percent, to $102.2 million, compared with 1958. Exploratory drilling accounted for six new oilfields and new pays. Eight oilfields in the county produced more than 1 million barrels of crude oil each. Natural-gas liquids were recovered at the West Seminole plant of Cities Service Oil Co. and the Seminole plant of Phillips Petroleum Co. The Seminole No. 66 channel plant of Columbian Carbon Co. recovered carbon black and sulfur from sour natural gas. Crushed limestone was quarried and prepared for concrete aggregate and roadstone by Elliott Taylor.

Galveston.—Mineral output was valued at $30.2 million, 5 percent less than in 1958. Exploratory drilling resulted in discovery of four new oilfields. The Gillock, South, and the High Island oilfields each produced in excess of 1 million barrels of crude oil during the year. The Wah Chang Corp. processed foreign ores at its Longhorn tin smelter at Texas City. Modernization programs resulted in quality improvement of tin metal to meet commercial specifications. Shell was dredged from the shallow bays surrounding Galveston by Horton & Horton and used for roadstone and in the manufacture of lime and cement. Paving sand and gravel was prepared by contractors for District 12 of the Texas Highway Department and the City Engineer of Galveston. The high pressure polyethylene capacity of the Texas City plant of Monsanto Chemical Co. was increased to 100 million pounds annually. Texas City Refining Co. installed a 7,000 barrel Houdriformer at its Texas City refinery to produce high octane gasoline from a variety of naptha feedstocks and a new petroleum coking unit with a 430-ton-a-day capacity. New facilities installed at the Texas City chemical plant of Union Carbide Chemicals Co. doubled its oxo-chemical capacity to 60 million pounds annually. A gas processing plant was planned by the Margaret Hunt Trust Estate at Alta Loma.

Garza.—Exploratory drilling resulted in the discovery of nine new oilfields and oil pays. The Garza oilfield produced more than 1 million barrels of crude oil. Building sand and gravel was prepared by Elliott Taylor. The Moreno Uranium Corp. produced uranium ore from open pits at its Eubanks operation.

Gillespie.—The value of nonmetallic minerals produced was 4 percent greater than in 1958. A total of 68,000 tons of building and paving sand and gravel was produced by five operators: Gilbert Gold, James Moellendorf, Alvin Usener, Weirich Bros., and Alfred E. Wunderlich. Rough monumental granite was quarried and prepared by Bear Mountain Quarries. Soapstone was mined from open pits by Southwestern Talc Corp.

Glasscock.—The value of crude petroleum production decreased nearly half, compared with 1958. Three new oilfields were discovered through exploratory drilling.

Goliad.—The value of crude oil and natural gas was $10.9 million, 24 percent less than in 1958. Exploratory drilling resulted in the discovery of four new oilfields.

Gonzales.—Total mineral value was 9 percent less than in 1958. Bentonitic clays were mined from open pits by Baroid Division, Natural Lead Co., and Southern Clay Products Co. Crushed sandstone was quarried and prepared as concrete aggregate and roadstone, and paving gravel was prepared by contractors for District 13 of the Texas Highway Department. Building and paving sand and gravel were prepared by Gonzales Gravel & Sand Co.

Gray.—Total mineral value increased 3 percent to $61.5 million, compared with 1958. Carbon black was recovered from natural gas at three plants of the Coltexo Corp. and Columbian Carbon Co. and from natural gas and natural-gas liquids at the Pampa plant of Cabot Carbon Co. Natural-gas liquids were recovered at seven gasoline plants of the following companies: Cities Service Oil Co., Coltexo Corp., Kerr-McGee Oil Industries, Inc., and Phillips Petroleum Co. The Panhandle Gray County oilfield produced more than 12 million barrels of crude oil.

Grayson.—The value of minerals produced was $21.2 million, 18 percent less than in 1958. Eight new oilfields and oil pays were discovered as a result of exploratory drilling. The Standard Oil Co. of Texas recovered natural-gas liquids at its Sherman gasoline plant. Crushed limestone was quarried and prepared as aggregate in concrete, riprap, and roadstone by S. E. Evans Mining Co. and Wray Wible Materials Co. A total of 70,000 tons of building and paving sand and gravel was produced by Ambrose Sand & Gravel, Southwest Sand Co., Texoma Transcrete Co., and various contractors for highway construction projects. A plant was built by Texas Oil Extraction Co. to recover the oil content of bleaching clays used in filtering and decolorizing edible oils.

Gregg.—The combined value of crude oil, natural gas, and natural-gas liquids production was $107.5 million, 9 percent less than in 1958. Two oilfields, the Danville/Pettit, Upper and the Willow Springs, East/Pettit, Lower, were discovered during the year. Crude oil was processed at the Longview refineries of Premier Oil & Refining Co. and Skelly Oil Co., and at the Gladewater refinery of Gladewater Refining Co. Six gasoline plants recovered natural-gas liquids. Texas Eastman Co. added oxochemical facilities to its Longview installations to raise aldehyde capacity to 125 million pounds annually, and expanded its polyethylene capacity to 100 million pounds annually. The Longview plant also produced cellulose acetate, butyrate, and propionate as well as limited quantities of polypropylene plastics.

Guadalupe.—The value of minerals produced was $11.2 million, 15 percent less than in 1958. The Darst Creek oilfield produced over 1 million barrels of crude oil during the year. Miscellaneous clay was mined from open pits near McQueeny by Fraser Brick & Tile Co. for use in the manufacture of brick and heavy clay products. Building and paving sand and gravel were produced by New Braunfels Sand & Gravel and Tiemann Sand & Gravel Co.

Hale.—The value of crude oil production increased 16 percent to $6.3 million, compared with 1958. The Anton-Irish oilfield produced over 2 million barrels of crude oil.

Hamilton.—The combined value of natural gas and sand and gravel produced was 41 percent less than in 1958. Paving gravel was produced by contractors for District 9 of the Texas Highway Department and building and paving sand and gravel were produced by Edward Craig.

Hansford.—The value of mineral fuels produced was $25 million, over 106 percent greater than in 1958. Crude oil, natural gas, and natural-gas liquids all contributed to the increase. Three new oilfields were discovered through exploratory drilling. Phillips Petroleum Co. recovered natural-gas liquids at its Hansford and Sherman gasoline plants.

Hardeman.—The value of minerals produced was 25 percent greater than in 1958. Crude oil and crude gypsum were produced during the year. Bestwall Gypsum Co. mined crude gypsum from open pits for use in the manufacture of wallboard and plaster.

Hardin.—The value of mineral fuels was $29 million, 8 percent less than in 1958. Exploratory drilling resulted in discovery of seven new oilfields and new pays. The Village Mills, East and the Sour Lake oilfields each produced more than 1 million barrels of crude oil. Number 25 and 26 cycling plants at Sinclair Oil & Gas Co. recovered natural-gas liquids from the Silsbee and Southampton gasfields.

Harris.—The value of mineral production, $103 million, was 4 percent less than the 1958 value. Four new oilfields were discovered during the year. Four oilfields, the Goose Creek, Pierce Junction, Tomball, and Webster, each produced more than 1 million barrels of crude oil. Five cycling and gasoline plants recovered natural-gas liquids. Carbon black was recovered from natural-gas liquids at the Elvon furnace plant of J. M. Huber Corp. Six refineries, having a total daily throughput of 519,500 barrels, processed crude oils from Texas, from adjoining States, and from foreign countries throughout the year. The Houston steel mill of Sheffield Division of Armco Steel Corp. processed Texas brown iron ores and foreign hematites on a limited basis owing to an extended work stoppage. Portland and masonry cements were manufactured from shell by Ideal Cement Co., Lone Star Cement Corp., and Trinity Division of General Portland Cement Corp. Barite from other States and from foreign countries was ground and prepared for heavy drilling mud by Milwhite Co., Inc., and Tejas Barite Co., Ltd. Clay used in brick and heavy clay products was mined from open pits by Acme Brick Co., J. N. Cordell & Sons, Inc., and Houston Brick & Tile Co. Lime was manufactured from shell by Champion Paper & Fiber Co. and Sheffield Division of Armco Steel Corp. Building and paving sand and gravel was produced by five companies and by contractors for District 12 of the Texas Highway Department. Salt was mined by United Salt Corp. and was obtained as salt in brine from wells by Texas Brine Corp. Facilities to increase daily capacity of caustic soda to 750 tons, chlorine to 750 tons, and high-purity hydrogen to 7.5 million cubic feet were completed at the Deer Park chemical plant of Diamond Alkali Co. Shell Oil Co. added a $2 million distillate hydrotreater to its Deer Park refinery to improve diesel fuel and furnace oil products. Standard Oil Co. of New Jersey merged all its domestic producing, refining, and marketing divisions into Humble Oil & Refining Co. with headquarters remaining in Houston. Humble Oil & Refining Co. planned a 9,500-barrel-a-day lubricating oil processing plant at its Baytown refinery. Extensions of crude capacity and finished products were planned for the Houston refinery of Eastern States Petroleum & Chemical Co. after the merger of Eastern States with Signal Oil & Gas Co. E. I. du Pont de Nemours Co., Inc., planned a $10 million sulfuric acid plant at Laporte to supply acid for its new caprolactram plant being built at Beaumont. Celanese Corp. of America began a $2 to $3 million expansion program at its Pasadena plant to increase polyethylene capacity from 40 million to 50 million pounds annually. Gulf Reduction Corp. completed an expansion program that raised its aluminum and zinc smelting and refining capacity to 800,000 pounds a month. Iron pipe and tube manufacturing facilities at the Houston mill of Tex-Tube Inc. were expanded at a cost of over $1 million. New facilities included an electric-weld pipe mill, a heat treating plant, and additions to the shop and office buildings. U.S. Gypsum Co. began production at its new $12 million gypsum, plaster, and wallboard plant at Galena Park in February. Plans to double the capacity were already being considered. Capacity of the Deer Park polyethylene plant of United States Industrial Chemicals Co. was increased to 115 million pounds annually. Further expansion to 200 million pounds annually was being planned. Petro-Tex Chemical Corp. added a 3,000-barrel-a-day alkylation unit and supplementary facilities to its Houston plant for the manufacture of butadiene, butylene, and di-isobutylene. A $500,000 expansion of the Houston plant of Pittsburgh Plate Glass Co. included an 80-million pound capacity polyester resin facility and a new laboratory and office building. Texas Alkyls, Inc., jointly owned by Hercules Powder Co. and Stauffer Chemical Co., completed a $1 million plant to manufacture various alkyls. Plant capacity was rated at 1 million pounds annually. A new phenol unit was added and bisphenol-A capacity of the Deer Park plant of Shell Chemical Corp. was increased. Milwhite Co., Inc. completed a new laboratory and office building at its Houston location. Western Natural Gas Co., an affiliate of El Paso Natural Gas Co., became a fully integrated oil company with the acquisition of Premier Oil Refining Co., which had refineries at Baird, Fort Worth, and Longview. Also included were three pipelines and gathering lines in east and west-central Texas and a chain of service stations in north Texas. Texas Butadiene & Chemical Corp. was licensed by Cosden Petroleum Corp. to manufacture polybutane under the Cosden license at its Channelview plant. The firm also was building a $500,000 low-temperature, butadiene pipeline and storage facilities to permit loading of refrigerated freighters at the rate of 250 tons an hour. Perlite, mined in other states, was expanded at the Houston plants of Perlite of Houston, Inc., and Tri-lite Corp. Crude vermiculite from domestic and foreign sources was exfoliated at the Houston plants of Tri-lite Corp. and Vermiculite Producers, Inc.

Harrison.—The value of minerals produced was $24.4 million, 8 percent less than in 1958. Three new oilfields were discovered during the year. Six gasoline plants recovered natural-gas liquids. Facilities were installed to raise the solid-rocket-propellant capacity of the Longhorn Ordnance Works of Thiokol Chemical Corp. from 500,000 to 1 million pounds a month. Miscellaneous clay and fire clay were mined from open pits near Waskom by Acme Brick Co. and from pits near Marshall by Marshall Brick Co. and Marshall Pottery Co. Most of the clay was used in the manufacture of brick and heavy clay products; stoneware and pottery manufacture used a minor quantity of fire clay. D'Arco Division of Atlas Powder Co. mined lignite from open pits for use in making activated carbons. The company completed a $500,000 research laboratory at its Marshall plant.

Hartley.—Production of natural gas increased 462 percent. Three new oilfields were discovered through exploratory drilling.

Haskell.—The value of crude oil produced was 12 percent greater than in 1958. Five new oilfields were discovered during the year.

Hemphill.—Crude oil output more than tripled. The Parsell/Cherokee oilfield was discovered during the year.

Henderson.—The value of mineral production increased 235 percent to $6.8 million. Natural-gas liquids were recovered at the Trinidad gasoline plant of Lone Star Gas Co. and the Opelika cycling plant of Lone Star Producing Co. Fire clay was mined from open pits near Athens by Athens Brick Co., Inc., Athens Tile & Pottery Co., Texas Clay Products Co., and Harbison-Walker Refractories Co. Most of the clay was used in building brick; heavy clay products, fire brick, and refractory shapes also consumed considerable quantities. Building and paving sand and gravel were produced by Turkey Creek Sand & Gravel Co. Texas Clay Products Co. added a new tunnel kiln, additional grinding and blending equipment, and an electronic weighing unit to increase its Malakoff plant capacity by about 25 percent.

Hidalgo.—The value of mineral output increased nearly 150 percent, to $28.3 million. The Bloomberg/Sullivan oilfield was discovered during the year. Crude oil was processed at the La Blanca refinery of Cactus Petroleum, Inc., and at the McAllen refinery of Caddo Refining Co. Natural-gas liquids were recovered at the gasoline plant of Delhi-Taylor Mayfair Oil Corp. and at the Tabasco plant of Anchor Gasoline Corp. Building brick was manufactured from miscellaneous clay mined from open pits by Valley Brick & Tile Co. Crushed limestone was quarried and prepared for concrete aggregate and roadstone. Building and paving sand and gravel were produced by Rio Grande Industries, Inc., and Fordyce Gravel Co.

Hill.—The value of mineral production increased greatly, compared with 1958. Limestone was quarried and crushed by contractors, and paving sand and gravel were prepared by contractors for District 9 of the Texas Highway Department. Crude oil was also produced during the year.

Hockley.—Production of mineral fuels was worth $39.6 million, 2 percent less than in 1958. Natural-gas liquids were recovered at the Ropes gasoline plant of Honolulu Oil Corp. and at the Levelland and Slaughter plants of Pan American Petroleum Corp.; the Slaughter plant also recovered sulfur from sour natural gas.

Hopkins.—The value of mineral production was 31 percent less than in 1958. Humble Oil & Refining Co. recovered natural-gas liquids at its Pickton gasoline plant. Fire clay was mined from open pits for use in the manufacture of fire brick and refractory shapes by A. P. Green Fire Brick Co. of Texas. A new 40,000-brick-a-day plant was being built near Sulphur Springs by Thermo Brick Co.

Howard.—An 8-percent decrease in the value of mineral production, $41.9 million, was reported. Exploratory drilling resulted in discovery of the Big Spring/Strawn and the Sand Springs/Fusselman oilfields. Four oilfields, Howard Glasscock, Iaton, East Howard, and Snyder, each produced more than 1 million barrels of crude oil. Building sand and gravel was prepared by West Texas Sand & Gravel Co. Cosden Petroleum Corp. processed crude oil at its Big Spring refinery. Cabot Carbon Co. recovered carbon black at its Dixon furnace plant. A new unifier and lightends unit was installed at the Big Spring refinery of Cosden Petroleum Corp.; polybutane capacity of the chemical unit was doubled to 2 million pounds annually.

Hudspeth.—The value of mineral production increased 38 percent, compared with 1958. Gypsum was recovered from open pits for use as a cement retarder by Southwestern Portland Cement Co. Contractors produced paving gravel for District 24 of the Texas Highway Department. Rhyolite was quarried and prepared for riprap, concrete aggregate, roadstone, and railroad ballast by Gifford-Hill & Co. Talc was recovered from open pits by Christian & Sons, Florida Tile Industries, Inc., Lone Star Mining Co., Southwestern Talc Corp., Texas Talc Co., and Westex Talc Corp. of Houston. Four additional mining companies were prospecting and developing other talc deposits in the area.

Hutchinson.—Mineral output was valued at $62.6 million, an increase of 13 percent over the value in 1958. Three new oilfields were discovered. The Panhandle Hutchinson County oilfield produced more than 12 million barrels of crude oil during the year. Natural-gas liquids were recovered at eight gasoline plants. Carbon black was recovered at four furnace plants and one channel plant; one plant used sour natural gas and three used gas liquids. Building and paving sand and gravel were prepared by Borger Readi-Mix Co. and Tri-City Sand & Gravel Co. Facilities to produce 20,000-tons-a-year of polybutadiene were installed at the Plains butadiene plant of Phillips Chemical Co. The Philtex plant of this company installed facilities to produce a new series of mercaptons. Crude oil was refined at the Borger refinery of Phillips Petroleum Co.

Irion.—Mineral production was 10 percent greater in value than in 1958. Exploratory drilling resulted in the discovery of seven new oilfields and new pays. Natural-gas liquids were recovered at the Mertcon Gasoline plant of Mertcon Corp.

Jack.—The value of mineral fuels and stone produced decreased 28 percent, compared with 1958. Exploratory drilling resulted in 10 oil discoveries during the year. Gasoline plants of Blackhawk Gasoline Corp., and Welstream Equipment Corp. recovered natural-gas liquids. Bryson Pipeline & Refining Co. processed crude oil at its Bryson refinery. Crushed limestone was quarried and prepared for concrete aggregate and roadstone by contractors for District 2 of the Texas Highway Department.

Jackson.—The value of mineral production increased 14 percent to $44.7 million, compared with 1958. The county led the State in the number of oilfield discoveries; 28 new fields or new pays were found. Two oilfields, West Ranch/41-A zone and West Ranch/98A zone each produced over 1 million barrels of crude oil. Natural-gas liquids were recovered at two gasoline plants and one cycling plant. Paving sand and gravel was prepared by South Texas Construction Co. and by contractors for District 13 of the Texas Highway Department. A completely automatic gasoline plant, capable of processing 40 million cubic feet of gas a day and recovering 27,000 gallons of liquids, was completed by Sunray Mid-Continent Oil Co. near Port Lavaca.

Jasper.—A 93-percent increase in the value of mineral production to $2.9 million, was reported. Six new oilfields were discovered during the year. Bentonitic clays were mined from open pits by Bennett-Clark Co., Inc.

Jefferson.—An increase of 22 percent in mineral output value, to $52.7 million, was reported. The Bauer Ranch, South/No. 1 Sand oilfield was discovered during the year. The Stowell oilfield produced more than 1 million barrels of crude oil. The Texas Gas Corp. recovered natural-gas liquids at its Texas gasoline plant. Six refineries processed crude oil in the county. Mobil Oil Co. replaced existing crude units at its Beaumont refinery with a new 100,000-barrel-a-day unit. Adjacent to the refinery, the company was building the world's largest ethylene plant with an annual capacity of 380 million pounds. The plant was to use waste refinery gases for raw stock. Propylene and butadiene also were to be produced. Gulf Oil Corp. added a pentane-isomerization unit to its Port Arthur refinery, raising the capacity of the platformer and hydrocarbon units to 12,000 barrels each. Other plant improvements included a 10,000-barrel-a-day deisobutanizer to recover isobutane from refinery gases, amine treating units to reduce the carbon dioxide content of ethylene, and new fractionation equipment to produce propylene and various polymers for use in detergent manufacture. E. I. du Pont de Nemours Co., Inc., began construction of two new plants at its petrochemical works on the Neches River near Beaumont. One plant would manufacture caprolactam, the other acrylonitrile, used in the manufacture of plastics, synthetic rubbers, and fibers. Platformer capacity of the Winnie gasoline plant of Texas Gas Corp. was increased to 3,000 barrels daily.

The plant processed gas from the Stowell gasfield. Miscellaneous clay was mined from open pits and used in brick and heavy clay products by Beaumont Brick Co., Inc. Building sand and gravel was prepared by C. A. McKinley Sons, Inc. Salt in brine was recovered from wells at the new Gladys City plant of Texas Brine Corp. Texas Gulf Sulphur Co. mined sulfur by the Frasch process at its Fannett Dome and Spindletop Dome. Sulfur was also recovered from sour crudes and casinghead gas at the Port Arthur refinery of Gulf Oil Co. and by Olin-Mathieson Chemical Corp. Texas Gulf Sulphur Co. planned a $3 million expansion of dock, storage, and shipping facilities at its Beaumont works on the Neches River. The improvements included a turning basin and 3,600 foot canal from the Neches River to the company storage area.

Jim Hogg.—The value of mineral production was 62 percent greater than in 1958. The Prado/3600 oilfield was discovered during the year.

Jim Wells.—The value of mineral production increased 17 percent to $71.7 million. Exploratory drilling resulted in discovery of 16 new oilfields and oil pays during the year. The Seeligson/Zone 9C–04 and the Stratton oilfields each produced more than 1 million barrels of crude oil during the year. The Seeligson gasoline plant of Mobil Oil Co. and the La Gloria cycle plant of the La Gloria Oil & Gas Co. recovered natural-gas liquids.

Johnson.—The value of stone, sand and gravel and lime was 11 percent greater than in 1958. Texas Lime Co. quarried limestone for use in the manufacture of lime and for metallurgical flux, concrete aggregate, roadstone, and soil conditioner. The lime was used for chemical and industrial purposes and for building materials. Various producers recovered sand and gravel for District 2 of the Texas Highway Department.

Jones.—The value of mineral output decreased slightly in 1959, to $18.3 million. A total of 13 new oilfields and new pays were discovered. Crude oil was processed at the Lueders refinery of Petroleum Products Co. The Wimberly No. 1 gasoline plant of Texas Natural Gasoline Corp. recovered natural-gas liquids. The R. E. Janes Gravel Co., Inc., produced building and paving sand and gravel. Rough architectural and dressed building stone were quarried and prepared by Lueders Limestone Co. and West Texas Stone Co. Crushed limestone for riprap was prepared by West Texas Stone Co.

Karnes.—The value of mineral production declined 6 percent to $9.3 million, compared with 1958. The Person/Edwards Upper oilfield was discovered. The Cabeza Creek and Karnes City gasoline plants of United Gas Pipeline Co. recovered natural-gas liquids.

Kaufman.—Mineral production decreased 7 percent from the 1958 figure. Limestone was quarried and prepared for concrete aggregate and roadstone by John F. Buckner & Sons. Crushed limestone was quarried and prepared by various producers for District 18 of the Texas Highway Department.

Kenedy.—The value of minerals produced was more than double the value in 1958. Humble Oil & Refining Co. recovered natural-gas liquids at its Julian Pasture cycle plant.

Kent.—Kent County mineral value increased 178 percent to $36 million, compared with 1958. Jayton/Penn, Lower oilfield was discovered. The Cogdell Area and the Salt Creek oilfields produced in excess of 1 million barrels of crude oil each. Building sand and gravel was prepared by Senn Gravel Co.

Kimble.—Sand and gravel, natural gas, and petroleum were produced. Value of production increased 120 percent, compared with 1958. Crude oil was produced from the Bass/Canyon and the Bolt oilfields. Paving sand and gravel was prepared by Weirich Bros.

King.—Mineral value declined 30 percent to $2.3 million. Two oilfields, the Katz, North/Lorentzen and the Tunstill, East/Delaware, were discovered during the year.

Kleberg.—The value of mineral production increased 64 percent to $19.9 million compared with 1958. A total of 18 oilfields and oil pays were discovered. Natural-gas liquids were recovered at the May gasoline plant of Arkansas Fuel Oil Corp. and the two Seeligson cycling plants at Humble Oil & Refining Co. Limestone was quarried and prepared for concrete aggregate and roadstone by Heldenfels Bros. Arkansas Fuel Oil Corp. built a $1.2 million gas-processing plant 50 miles east of Kingsville. The plant was to process 34 million cubic feet of gas daily and to recover 29,000 gallons of liquids. A 70-million-cubic-foot gas-processing plant of Standard Oil Co. of Texas began processing offshore oil production early in 1959.

Knox.—The value of crude oil production increased 60 percent. Seven new oilfields and oil pays were discovered.

Lampasas.—Production of stone and sand and gravel declined more than 61 percent, compared with 1958. Limestone was quarried and prepared for concrete aggregate and roadstone by contractors for District 23 of the Texas Highway Department. The Lampasas Sand-Gravel Co. prepared building and paving sand and gravel.

LaSalle.—A 3 percent increase in the value of mineral production was reported. The Cartwright Ranch/5200 Sand and the Washburn, West/Wilcox oilfields were discovered during the year.

Lavaca.—The value of mineral production declined 55 percent, to $8.7 million, compared with 1958, because of reductions in the outputs of oil, natural gas, and natural-gas liquids. Two new oilfields, Hallettsville/7400 Sand and the Chicolete Creek, East/8650, were discovered during the year. Natural-gas liquids were recovered at the Wilcox plant of Goliad Corp. and the Provident City plant of Shell Oil Co. Sand and gravel and crushed limestone were prepared on contract for District 13 of the Texas Highway Department.

Liberty.—The value of mineral production decreased 7 percent to $50.6 million, compared with 1958. Spur Oil Co., which purchased the Hull gasoline plant of West Gasoline Co., planned a $1 million modernization and expansion program that would increase the daily capacity of the plant from 5 million cubic feet to 20 million cubic feet. The new facilities would end the flaring of gas from many wells in the Hull field. Exploratory drilling led to the discovery of Hathaway/Yegua-A and Yegua-B oilfields. The Liberty, South and the Hull oilfields each produced more than 1 million barrels of crude oil. Natural-gas liquids were recovered at the Hull gasoline plant of Spur Oil Co. Sulfur was mined by the Frasch process at the Moss Bluff Dome by Texas Gulf Sulphur Co. Paving sand and gravel was prepared by Texas Construction Material Co.

Limestone.—Mineral production was valued at $1.8 million, 16 percent less than the 1958 value. Barron Brick Co. mined clay from open pits for use in building brick and heavy clay products. Crushed limestone was quarried and prepared by Fred Hull & Son for Districts 18 and 19 of the Texas Highway Department.

Lipscomb.—The value of crude oil and natural gas production amounted to $1.1 million. Five new oilfields and new pays were discovered during the year.

Live Oak.—The value of mineral production increased 2 percent to $13.6 million. A total of 15 new oilfields and oil pays were discovered. Building and paving sand and gravel were produced by various operators for the Texas Highway Department.

Llano.—Mineral value declined 4 percent from 1958. Dressed monumental granite was quarried and prepared by Premier Granite Quarries. Marble was quarried and prepared for roofing material and paint filler by Dezendorf Marble Co. Magnetite was shipped from stockpile by Boyd Callan, Inc. for use as heavy aggregate in concrete. Graphilter Corp. quarried and prepared graphitic schist as a filter medium. Feldspar was shipped from stockpile by the Moss estate.

Loving.—The value of mineral production increased 36 percent, compared with 1958. Three oilfields, Tunstill, East/Delaware, Elmar/Delaware, and Twofreds, Northeast/Bell Canyon, were discovered through exploratory drilling.

Lubbock.—The total value of crude oil, sand and gravel outputs declined 33 percent, compared with 1958, due to reduced oil production. Caprock Sand-Gravel Co. prepared building and paving sand and gravel.

Lynn.—The value of crude oil output was 63 percent greater than in 1958. Two new oil pays, the Y.W.O./Glorieta and the San Andres, were discovered through exploratory drilling.

McCulloch.—The value of mineral output increased 171 percent to $323,000. Sand for industrial uses was prepared by San Saba Sand Co. Crushed limestone was quarried and prepared by contractors for concrete aggregate and roadstone for District 23 of the Texas Highway Department. A $500,000 plant to mine and process 24 carloads of Frac sand for the petroleum industry was built near Brady by the Heart of Texas Mining Co. A second plant in Brady was to process the sand further.

McLennan.—The value of mineral production increased 18 percent to $4.7 million. Limestone and clay were mined from open pits by Universal Atlas Cement Co. for manufacturing portland and masonry cements at its Waco plant. Building stone was quarried and dressed by Tonk Quarry. Limestone was quarried and crushed, and paving gravel was prepared by various contractors for concrete aggregate and roadstone for District 9 of the Texas Highway Department. Building and paving sand and gravel were prepared by four producers: C. F. Binner & Son, Central Texas Gravel Co., Kleberg Sand & Gravel Co., and Neeley Sand & Gravel Co.

McMullen.—The value of mineral output was 11 percent less than in 1958. Six new oilfields and new pays were discovered during the year.

Madison.—Crude oil and natural gas production was 4 percent less than production in 1958. The Madisonville/Sub Clarksville oilfield was discovered.

Marion.—Two new oilfields, the SSGL/Macatosh and the Ware/Pettit were discovered. The value of mineral output was slightly greater than in 1958, amounting to $7.6 million. Arkansas-Louisiana Chemical Co. recovered natural-gas liquids at its Jefferson gasoline plant.

Martin.—Value of crude oil production was 57 percent greater than in 1958. Three new oilfields, the Gordon Street/Wolfcamp, Wolcott/Wolfcamp and Breedlove/Strawn, were discovered during the year.

Mason.—The value of sand and gravel production was 29 percent less than in 1958. Building and paving sand and gravel were produced by Weirich Bros.

Matagorda.—The value of mineral production declined 18 percent to $29.4 million. Discovery of 18 new oilfields and new pays was reported during the year. Natural-gas liquids were recovered at the Blessing cycling plant of American Liberty Oil Co. and at the Markham gasoline plant of the Ohio Oil Co. Miscellaneous clay was mined from open pits by Pal-Port Clay Products Corp. for use in the manufacture of brick and heavy clay products. Paving sand and gravel was prepared by contractors for District 12 of the Texas Highway Department. Shell was dredged from bays adjoining Matagorda County by Matagorda Shell Co. A 50 million cubic-foot-a-day gas processing plant was planned for the Palacios field by Christie, Mitchell & Mitchell Co.

Maverick.—The value of crude oil and natural gas output was 125 percent greater than in 1958. Four new oilfields and new pays were discovered.

Medina.—The value of mineral output was 38 percent greater than in 1958. Miscellaneous clay was mined from open pits by D'Hanis Brick & Tile Co. for use in manufacturing brick and heavy clay products.

Menard.—Natural gas was produced from the Canyon Lime of Menard gasfield.

Midland.—A decline of 32 percent in the value of mineral output to $38.1 million was reported. Two new oilfields, the Azalea/Bend and the Tex-Harvey/Strawn, were discovered during the year. Four gasoline plants recovered natural-gas liquids. Three oilfields, Spraberry/Trend Area, Virey/Ellenburger and Dora Roberts/Ellenburger, each produced in excess of 1 million barrels of crude oil.

Milam.—Mineral production increased 15 percent in value, compared with 1958. Lignite was mined from open pits by Industrial Generating Co. and used as fuel in generating electric power. Crude oil and natural gas were also produced. Alcoa operated its Rockdale aluminum reduction works at about 80 percent capacity through most of 1959. Alumina from the company's new Point Comfort plant supplied the feed for the reduction plant.

Mitchell.—Mineral production declined 26 percent in value to $6 million. Exploratory drill projects by the oil industry discovered the Turner-Gregory/San Andres oilfield. Westbrook oilfield produced more than 1 million barrels of crude oil. Building and paving sand and gravel were prepared by Colorado Sand & Gravel Co. Cosden Oil Co. produced crude oil at its Colorado City refinery.

Montague.—The value of mineral output was 12 percent below that of 1958. Five new oilfields and oil pays were discovered through exploratory drilling. Montague County Regular oilfield produced in excess of 1 million barrels of crude oil during the year. Bowie Gasoline Co. recovered natural-gas liquids at its Bowie gasoline plant. Building and paving sand and gravel were prepared by Watson Sand & Gravel Co. and by various other producers. Paving gravel and crushed limestone for concrete aggregate and roadstone were prepared by contractors for District 3 of the Texas Highway Department.

Montgomery.—The value of mineral output declined 6 percent to $29.9 million. Splendora/6600 Yegua oilfield was discovered during the year. Two gasoline plants and one cycling plant recovered natural-gas liquids from Conroe, Bender & Fostoria gasfields. The Conroe No. 63 furnace plant of Columbian Carbon Co. recovered carbon black from both natural gas and natural-gas liquids. Paving sand and gravel was produced under contract for District 12 of the Texas Highway Department.

Moore.—Mineral production was valued at $40.8 million, 11 percent greater than in 1958. A $13 million helium extraction plant was proposed in the Sunray area by Helex Co., organized jointly by Air Products Co., Inc., of Allentown, Pa., and Northern Natural Gas Co. of Omaha, Neb. The plant would process 120 million cubic feet of natural gas to recover approximately 260 million cubic feet of helium annually. A $1.6 million modification and expansion program of the Federal Bureau of Mines Exell helium plant increased gas extraction capacity of the installed facilities and integrated these units with completed new units. American Zinc Co. of Illinois operated its Machovec zinc retort smelter at reduced capacity through most of 1959, treating ores and concentrates from other states and foreign countries. An 8,000-barrel, fresh-feed Thermofor catalytic cracker was added to the McKee refinery of Shamrock Oil & Gas Corp. Natural-gas liquids were recovered at six gasoline plants that processed gas from West Panhandle, Texas-Hugoton, and Panhandle fields. Crude oil was processed at the McKee plant of Shamrock Oil & Gas Corp. Natural gas and natural-gas liquids were used at the Continental furnace plant of Continental Carbon Co. for recovering carbon black. Sulfur was recovered from sour crudes and sour natural gas at the McKee plant of Shamrock Oil & Gas Corp.

Morris.—Mineral output increased 42 percent, compared with 1958. Building and paving gravel was produced by Grande Prairie Construction Co. Brown iron ores were mined from open pits by Lone Star Steel Co. and upgraded at the ore mill at Daingerfield for blast furnace feed. The Daingerfield steel mill became the Nation's first plant to use natural gas as blast furnace fuel and reductant on a continuous basis. This experimental practice resulted in improvement in both pig iron production and coke-to-ore ratio.

Motley.—The value of crude oil and sand and gravel output was 136 percent greater than in 1958. Building and paving sand and gravel were prepared by Caprock Sand & Gravel Co., Harris Sand & Gravel Co., and Leo Thrasher.

Nacogdoches.—The value of natural gas and clay output was 81 percent more than the value in 1958. Natural gas was recovered from Douglas/Rodessa, Harris/Lower Pettit, and Hill Sand pays, and Trawick/Pettit gasfield. Acme Brick Co. mined miscellaneous clay from open pits near Garrison for use in manufacture of brick and heavy clay products.

Navarro.—The value of mineral output declined 5 percent to $6.5 million as compared with 1958. The Corsicana rockwool plant of American Rockwool Corp. was acquired by U.S. Gypsum Co. on July 1. Whiteselle Brick-Lumber Co. mined miscellaneous clay from open pits near Corsicana for brick and heavy clay products. Limestone was quarried and crushed, and paving gravel was recovered by contractors for concrete aggregate and roadstone for District 18 of the Texas Highway Department. Building and paving sand and gravel were prepared by Trinity Sand & Gravel Co.

Newton.—The value of crude oil and natural gas production was 25 percent less than in 1958. New oil discoveries included Quicksand Creek/10,100 Wilcox, Quicksand Creek/10,260 Wilcox, and Dougar, East/Y-4-A.

Nolan.—The mineral output was valued at $38.8 million, 13 percent greater than in 1958. Two new oil discoveries in the Ellenburger, RDN, and Beckman West and one in the Cisco/Beckman West were reported during the year. Natural-gas liquids were recovered at five plants. Lone Star Cement Corp. quarried and prepared limestone and mined miscellaneous clay from pits for use in manufacture of portland and masonry cement at its Maryneal plant. U.S. Gypsum Co. mined gypsum from open pits near Sweetwater for use in manufacture of plaster, wallboard, lath, and other gypsum products for the building industry. Hillsdale Gravel Co. prepared building and paving sand and gravel.

Nueces.—The value of minerals produced increased 2 percent to $80.6 million, compared with 1958. American Smelting & Refining Co. integrated the electrolytic refining and alloying operations at its Corpus Christi electrolytic zinc plant to permit better quality control of zinc alloys. A new lightweight aggregate plant, using local clays, was built at Robstown by Robstown Clay Products Co. Delhi-Taylor Oil Corp. built a new digital computor center adjacent to its Corpus Christi refinery for control of its refinery operations. Crude oil capacity of the Corpus Christi refinery of Howell Refining Co. was expanded to 6,500-barrels-a-day. A $3 million, 7,000-barrel-a-day, delayed coking unit was built adjacent to the Corpus Christi refinery of Suntide Refining Co. by Coastal Products Co. Coastal Products Co. was jointly owned by Suntide and Sunray Mid-Continental Oil Co. Fourteen new oilfields and oil pays were discovered. Nueces County was the State's second ranking county in natural gas production. Crude oil was processed at six refineries having a total daily throughput capacity in excess of 231,000 barrels. Natural-gas liquids were recovered at seven gasoline and four cycling plants. Columbian Carbon Co. recovered carbon black at its Corpus Christi No. 56 channel plant. Building and paving sand and gravel were prepared by Heldenfels Bros. and Martin Paul Wright. Shell used for concrete aggregate, roadstone, and manufacture of lime and cement was dredged from shallow bays surrounding the county by Corpus Christi Shell Co., Heldenfels Bros., and Matagorda Shell Co. Portland and masonry cements were manufactured from shell and local clay at the Corpus Christi plant of Halliburton Portland

Cement Co. Lime for industrial, chemical, and building purposes was manufactured from shell by Columbia- Southern Chemical Corp. Clay, used in the manufacture of lightweight aggregate, was mined from open pits adjacent to the Robstown plant of Robstown Clay Products Co.

Ochiltree.—The value of crude oil, natural gas, and natural-gas liquids production increased 127 percent to $14.9 million compared with 1958. New oilfields and new oil pays discovered totaled 14. Natural-gas liquids were recovered at the Spearman gasoline plants of Northern Natural Gas Co. and Skelly Oil Co.

Oldham.—The value of crude oil and sand and gravel was 13 percent less than in 1958. Alamosa, Southeast/Missouri oilfield was discovered during the year. Building sand and gravel was prepared by Western Aggregates, Inc., and Western Sand & Gravel Co.

Orange.—Mineral production value declined 24 percent as compared with 1958. Orange oilfield produced in excess of 1 million barrels of crude oil. Gulf States Utilities Co. planned a multimillion dollar, 1 million-kilowatt power plant near Orange. The first turbogenerator unit had a rated capacity of 220,000-kw. A new $6.5 million, 20,000-barrel-a-day refinery was planned near Orange by Natural-Gas Liquids Corp. The Orange County Navigation and Port District planned to improve port facilities and provide site acreage, foundations, and other improvements for refinery installations. Phillips Chemical Co. began constructing a 60-million-pound-a-year carbon black plant near the Texas Portland Cement Co. plant, northeast of Orange. Firestone Tire & Rubber Co. was building facilities to produce 30,000 tons of two new synthetic rubbers. The two new synthetics were Diene—a butadiene base, and Coral—an isoprene base. Natural-gas liquids were recovered at the Phoenix Lake plant of Ohio Oil Co. Portland cement was manufactured from shell and clay at the Orange cement plant of Texas Portland Cement Co.

Palo Pinto.—Mineral output value increased 60 percent. Brazos River Gasoline Co., at Mineral Wells, and Lone Star Gas Co. at its Gordon gasoline plant, recovered natural-gas liquids. Miscellaneous clay, used in manufacture of brick, tile, lightweight aggregate, and heavy clay products, was mined from open pits near Mineral Wells by Texeramics Co., Texas Vitrified Pipe Co., Reliance Clay Products Co., and Bill Williams Materials Corp. Building sand and gravel was recovered from pits near Mineral Wells by Mineral Wells Sand & Gravel Co. Various contractors quarried and prepared crushed limestone for concrete aggregate and roadstone for District 2 of the Texas Highway Department.

Panola.—Mineral production value declined 24 percent to $59.5 million. Exploratory drilling discovered the Bethany/Jenkins Sand oilfield. Natural-gas liquids were recovered at five gasoline plants and one cycling plant. Panola County was the largest natural gas producer in the State.

Parker.—Mineral production was valued at $2.4 million, twice as much as in 1958. Exploratory drilling proved the Poolville, West/Caddo Lime and Strawn oilfields. Natural-gas liquids were recovered at the Springtown gasoline plant of Lone Star Gas Co. Miscellaneous clay, used in manufacture of brick and heavy clay products, was mined from open pits near Bennett by Acme Brick Co. and Mineral Wells Clay Products Co. Crushed limestone for concrete aggregate and roadstone was produced by Industrial Concrete Supply Co., Inc., and by contractors for District 2 of the Texas Highway Department.

Pecos.—The value of mineral production increased 37 percent to $61.8 million as compared with 1958. Nine new oilfields and oil pays were discovered during the year. Three oilfields, Ft. Stockton, Pecos Valley/High Gravity, and Yates, each produced more than 1 million barrels of crude oil. Natural-gas liquids were recovered at the Puckett gasoline plant of Phillips Petroleum Co. and the Santa Rosa plant of Pecos Co. Contractors quarried and prepared crushed limestone for concrete aggregate and roadstone for District 6 of the Texas Highway Department. F.M. Reeves & Sons, Inc., prepared building and paving sand and gravel.

Polk.—The $5.2 million value of mineral production was 4 percent greater than the value in 1958. Special industrial sands were recovered from pits near Corrigan and prepared by Texas Construction Material Co. Crude oil and natural gas were produced during the year.

Potter.—The value of mineral production increased 94 percent to $12.7 million, compared with 1958. Helium was produced and refined at the Federal Bureau of Mines plant near Amarillo. Natural-gas liquids were recovered at the Fain and Turkey Creek gasoline plants of Amarillo Oil Co. American Smelting & Refining Co. operated its Amarillo zinc retort smelter at reduced capacity through most of 1959. Zinc concentrates and ores from Western States and foreign countries were smelted during the year. Building and paving sand and gravel were recovered and processed from pits near Amarillo by Panhandle Gravel, Inc., and Texas Sand & Gravel Co., Ltd. Limestone (caliche) was quarried and prepared for concrete aggregate and roadstone by Texas Sand & Gravel Co. Crude oil was processed at the Amarillo refinery of Texaco, Inc.

Presidio.—Crushed limestone was quarried and prepared by contractors for concrete aggregate and roadstone for District 24 of the Texas Highway Department.

Reagan.—Mineral production was valued at $36.3 million, 9 percent more than in 1958. Two oilfields, Barnhart/Wolfcamp and Zulette/Ellenburger, were discovered through exploratory drilling. Spraberry/Trend Area oilfield produced more than 1 million barrels of crude oil during 1959. Natural-gas liquids were recovered at three gasoline plants. Sulfur was recovered by the modified Claus process from sour gas at the Big Lake plant of Barnhart Hydrocarbon Co.

Red River.—Crude oil and Buzbee and I and L/Paluxy oilfields was the only mineral production reported in 1959.

Reeves.—The value of mineral production increased 129 percent to $5.8 million as compared with 1958. Three new oilfields, Orla, Southeast/Delaware, Pecos, North/Delaware, and Screwbean East/1000 Sand were discovered. A portable gasoline plant to process 5 million cubic feet a day was built near Pecos by Continental Oil Co. The plant was mounted on skids and could be moved from one location to another. The Tunstill gasoline plant of Pecos Petroleum Co. and the new Ramsey No. 16 gasoline plant of Continental Oil Co. recovered natural-gas liquids. F. M. Reeves & Sons, Inc. prepared building and paving sand and gravel.

Refugio.—Mineral production increased only 2 percent in value to $64.9 million, despite discoverey of 20 new oilfields and new pays. Two oilfields, Greta and Tom O'Connor, each produced in excess of 1 million barrels of crude oil. Two gasoline plants, A.G.S.C.O. and Tom O'Connor of Humble Oil & Refining Co., recovered natural-gas liquids.

Roberts.—Output of crude oil and natural gas was valued at $5.4 million, 29 percent more than in 1958. Three new oilfields, Red Deer/Albany, Red Deer/Pennsylvanian, and Lips, South/Atoka were discovered.

Robertson.—Output of crude oil, natural gas and sand and gravel declined 37 percent, compared with 1958. Gifford-Hill & Co., Inc. recovered sand and gravel for building and paving from pits near Hearne. A new brick plant was planned by Duncan & Powers at a site near Bremond.

Runnels.—The value of mineral production increased 50 percent to $23.6 million. Jarvis Sand & Gravel Co. prepared building and paving sand and gravel. Exploratory drilling found 17 new oilfields and oil pays. Ft. Chadbourne oilfield produced more than 1 million barrels of crude. Three gasoline plants recovered natural-gas liquids.

Rusk.—Mineral output declined 14 percent from 1958 to $65.3 million. Four new oilfields and new pays were discovered. Natural-gas liquids were recovered at the East Texas plant of Humble Oil & Refining Co., the Giles plant of Parade Co., and Plants 19 and 21 of Sinclair Oil & Gas Co. Miscellaneous clay, used in building brick and heavy clay products, was mined from open pits near Henderson by J. M. Cordell & Sons, Inc., and Major Brick Co. Fire clay was mined from open pits for use in the manufacture of building and face brick by Henderson Clay Products, Inc.

San Jacinto.—The output of crude oil, natural gas, and sand and gravel declined 36 percent in value to $1.6 million. Thorstenberg Material Co. dredged sand and gravel from pits near Shepherd for building and paving. Cold Springs/Wilcox 7525 oilfield was discovered during 1959.

San Patricio.—The mineral industry increased the value of output 11 percent to $49.7 million, compared with 1958. A total of 23 new oilfields and oil pays were discovered. Plymouth and White Point, East oilfields each produced in excess of 1 million barrels of crude oil. Natural-gas liquids were recovered at Redfish Bay gasoline plant of Sunray Mid-Continent Oil Co., Plant No. 20 of Sinclair Oil & Gas Co., Portilla gasoline plant of Superior Oil Co., and Plymouth cycling plant of Plymouth Oil Co. Crushed limestone was quarried and prepared for concrete aggregate and roadstone by Fordyce Gravel Co. and Heldenfels Bros. Building and paving sand and gravel were prepared by Fordyce Gravel Co. and Gulf Materials Co. The La Quinta alumina plant and San Patricio aluminum reduction works of Reynolds Metals Co. operated at reduced capacity throughout the year. A $1 million expansion program at the La Quinta plant included a 450-foot dock, an electrically operated conveyor system, a 9,000-ton storage silo, and an unloading ramp that would permit loading alumina into tankers at a rate of 600 tons an hour.

Schleicher.—The value of mineral output increased 33 percent. Production was limited to crude oil, natural gas, and natural-gas liquids. Five new oilfields and new oil pays were discovered during the year. Hulldale/Penn Reef oilfield produced more than 1 million barrels of crude oil. Sinclair Oil & Gas Co. recovered natural-gas liquids at its No. 23 gasoline plant.

Scurry.—Scurry County was the fourth-ranking oil producer and ranked fifth in the State in total mineral value, although the 1959 value of mineral output declined 4 percent to $119 million, compared with 1958. Exploratory drilling proved the Fluvanna, Northeast/Strawn oilfield. Diamond M/Canyon Lime Area, Kelly-Snyder, Revilo/Glorieta, and Sharon Ridge/1700 oilfields each produced more than 1 million barrels of crude oil. Four gasoline plants recovered natural-gas liquids. Miscellaneous clay was mined from open pits for brick and heavy clay products by Southwestern Brick & Tile Co.

Shackelford.—Mineral fuels output declined 2 percent in value to $10.4 million compared with 1958. A total of eight new oilfields and oil pays were proved through exploratory drilling. Shackelford County oilfield produced more than 1 million barrels of crude during the year. Natural-gas liquids were recovered at No. 1 gasoline plant of Marshall R. Young and Graridge No. 1 plant of Graridge Corp.

Shelby.—The value of crude oil and natural gas production declined 31 percent to $1.4 million, compared with 1958. Ernest Hill/Blossom Sand oilfield was discovered during the year.

Sherman.—The value of crude oil and natural gas production increased 27 percent to $7.8 million as compared with 1958.

Smith.—Minerals valued at $11.6 million were produced in Smith County, an increase of 27 percent over the 1958 value. Seven new oilfields and new pays were discovered. Chapel Hill gasoline plant of Etexas Producers Gas Co. and Chapel Hill cycling plant of Lone Star Producing Co. recovered natural-gas liquids. Tyler refinery of LaGloria Oil & Gas Co. processed crude oils. Miscellaneous clay, used to manufacture brick and heavy clay products, were mined from open pits by Reliance Clay Products Co. Industrial sands were processed by H. J. Ellis Sand Co. A $400,000 expansion program at the Tyler plant of American Clay Forming Co. permitted increased production and diversification of porcelain enamel products.

Starr.—Mineral output was valued at $23 million, 7 percent greater than in 1958. A total of 24 new oilfields and oil pays were discovered. Rincon gasoline plant of Continental Oil Co. and Sun plant of Sun Oil Co. recovered natural-gas liquids. Crushed limestone was quarried and prepared for railroad ballast by Fordyce Gravel Co.; building and paving sand and gravel also were prepared. Valley Brick & Tile Co. mined miscellaneous clay from open pits for the manufacture of brick and heavy clay products.

Stephens.—The value of mineral production declined 63 percent to $10.1 million in 1959. Four new oilfields and new pays were discovered. Four gasoline plants recovered natural-gas liquids. Building sand and gravel was prepared from open pits by Taylor Brothers.

Sterling.—A 21-percent increase in mineral production value to $2 million was reported.

Stonewall.—The value of mineral output declined 6 percent to $23.3 million but 10 new oilfields and oil pays were discovered during the year. Katz and Flowers/Canyon Sand oilfields each produced in excess of 1 million barrels of crude oil. Cities Service Oil Co. recovered natural-gas liquids at its Stonewall gasoline plant. The Stonewall plant processed gases from various fields in King, Knox, Haskell, and Stonewall Counties. Building and paving sand and gravel were recovered from open pits by Hamlin Sand & Gravel, Inc.

Sutton.—Crude oil and natural gas production was valued at $1.2 million.

Tarrant.—The $12.7 million value of mineral output was 5 percent greater than the value in 1958. Crushed limestone was quarried and prepared for making portland and masonry cements by Trinity Division of General Portland Cement Co. Limestone for building stone was quarried and dressed by Carruthers Cutstone Co. Building and paving sand and gravel were prepared by 12 producers. Western Mica Co. ground and prepared mica. A $500,000 plant to manufacture lightweight building block was completed by Western Builders Supply Co. at Hearst.

Taylor.—The value of mineral production increased 30 percent over that of 1958. A total of 15 new oilfields and oil pays were discovered. Taylor County Regular oilfield produced in excess of 1 million barrels of crude oil. Abilene Brick Co. mined miscellaneous clay from open pits for brick and heavy clay products. Crude oil was processed at the Abilene refinery of Debco Corp. Crushed limestone was quarried and prepared for concrete aggregate and roadstone by H. B. Zachry & Co. Building and paving sand and gravel were prepared by Atlas Sand & Gravel Co. and Caton Sand & Gravel Co.

Terry.—The value of mineral production was 31 percent less than 1958. Tokio, South/Clearfork oilfield was discovered during 1959. Adair/Wolfcamp oilfield produced more than 1 million barrels of crude oil during the year. Natural-gas liquids were recovered at the Adair gasoline plant of Amerada Petroleum Corp. and Wellman plant of Chillgas Corp. Seagraves No. 64 furnace plant of Columbian Carbon Co. recovered carbon black from sour natural gas and gas liquids. Sodium sulfate was recovered from brines at the Brownfield plant of Ozark Mahoning Co. Various producers processed paving sand and gravel for highway construction.

Throckmorton.—The value of mineral production declined 3 percent to $11.9 million as compared with 1958. New oilfields and oil pays discovered during the year totaled 18. Throckmorton County Regular oilfield produced in excess of 1 million barrels of crude oil during the year. Paving gravel was produced on contract for District 3 of the Texas Highway Department.

Titus.—The value of crude oil production declined 4 percent compared with 1958. Crude oil was processed at the Mt. Pleasant refinery of American Petrofina Co. of Texas. The company added a 3,000-barrel Platformer and a 1,500-barrel hydrofluoric acid alkylation unit to its Mt. Pleasant refinery.

Tom Green.—The mineral production value declined 16 percent to $5.1 million as compared with 1958. One oilfield, Atkinson, Northeast/Strawn Reef, was discovered. Building and paving sand and gravel were prepared by Montgomery Sand & Gravel Co. and other producers.

Travis.—The value of mineral production declined 45 percent from the 1958 figure to $3.1 million. Limestone was quarried and prepared for manufacturing lime by Austin White Lime Co. The lime was used by the building and chemical industries. Limestone was quarried and crushed for riprap, metallurgic flux, railroad ballast, concrete aggregate, and roadstone by Austin White Lime Co. and Texas Crushed Stone Co. Dressed building limestone was prepared by Texas Quarries, Inc., from stone quarried in Williamson County. Building and paving sand and gravel were prepared by Capital Aggregates, Inc., and Travis Materials Co. Grinding pebbles were prepared by Dezendorf Marble Co.

Trinity.—Crude oil, natural gas, and stone production was valued at $4.2 million in 1959. Sandstone was quarried and crushed for concrete aggregate and roadstone by contractors for District 11 of the Texas Highway Department.

Upshur.—Mineral output value declined 8 percent to $6.1 million as compared with 1958. One oilfield, New Diana/Woodbine, was discovered. Building and industrial sands were prepared near Big Sandy by the Big Sandy Sand & Gravel Co.

Upton.—The $50.6 million mineral output was 6 percent less than the 1958 value. Two oilfields, Amacker Trippett Detrital and Fradeon/Ellenburger, were discovered during 1959. Three oilfields, McCamey, Pegasus/Ellenburger, and Wilshire/Ellenburger each produced in excess of 1 million barrels of crude oil. Five gasoline plants recovered natural-gas liquids. Shell Oil Co. built a 30-million-cubic-foot-a-day gasoline plant in the Crossett field near McCamey.

Uvalde.—Mineral production was valued at $3.3 million, a moderate increase over 1958. Native asphalt was quarried and prepared for road-surfacing from pits near Dabney by White's Uvalde Mines and from pits near Blewett by Uvalde Rock Asphalt Co. Southwest Stone Co. quarried and prepared basalt for rip rap, concrete aggregate, roadstone, and railroad ballast. Building and paving sand and gravel were prepared by D-D Gravel Co.

Val Verde.—Crude oil, natural gas, and sand and gravel were valued at $726,000. Various producers processed paving sand and gravel during the year. Two oilfields, Devils River/Paluxy and Massie, West/Paluxy, were discovered.

Van Zandt.—The value of mineral fuels and salt produced was $22.9 million, 4 percent less than the 1958 value. Van oilfield produced more than 5 million barrels of oil. The Van gasoline plant of Pure Oil Co. recovered natural-gas liquids. Rock salt was recovered from underground mines and salt in brine was recovered from wells by Morton Salt Co. near Grand Saline.

Victoria.—The value of mineral production amounted to $20.7 million, 34 percent less than the 1958 value. E. I. du Pont de Nemours Co., Inc., planned a 60-million-pound-a-year polyethylene resin unit at its Victoria works; completion was scheduled for early 1961. Five new oilfields and new pays were proved through exploratory drilling. Building and paving sand and gravel were prepared from pits by Fordyce Gravel Co., Gulf Materials Co., Heldenfels Bros., and South Texas Construction Co. Fordyce Gravel Co. quarried and crushed limestone for use as concrete aggregate and roadstone.

Walker.—The value of crude oil and clay produced amounted to $196,000, 9 percent greater than in 1958. The Milwhite Co., Inc., recovered bentonitic clay from open pits near Riverside for use in heavy drilling muds and filtering and decolorizing media.

Waller.—Mineral fuels and sand and gravel produced were valued at $37.9 million, 40 percent greater than in 1958. Humble Oil & Refining Co. recovered natural-gas liquids at its Katy cycling plant. Paving and construction sand and gravel were prepared for District 12 of the Texas Highway Department and Waller County Road and Bridge Department.

Ward.—Minerals valued at $68.9 million were produced, a 33-percent increase over 1958. Five new oilfields and oil pays were discovered. Each of the following oilfields produced in excess of 1 million barrels of crude oil during 1959: Shipley/Queen Sand, Ward, South Field, and Ward-Ester, North Field. Crude oil was processed at the Wickett refinery of Wickett Refining Co. Natural-gas liquids were recovered at three gasoline plants. Sodium sulfate was recovered from salt wells and drylake brines at the Monahans plant of Ozark Mahoning Co. Permian Sand & Gravel Co. prepared building and paving sand and gravel from pits near Royalty.

Washington.—The value of crude oil and natural gas produced was 10 percent less than in 1958. Clay Creek/4700 Wilcox, Lower oilfield was discovered during 1959.

Webb.—The mineral production value of $6.3 million was 41 percent greater than in 1958. Antimony ores from Mexico were processed at the Laredo smelter of National Lead Co. under Government contract. Three new oilfields, Que Sera, Southwest/Mirando, Malo Sueno/5500 Sand, and Luisa/1400 Frio, were discovered. Miscellaneous clay used in brick and heavy clay products was mined from open pits by Richard Chavana and E. C. Delachica Clay Co. Paving gravel was prepared for the City Engineer of Laredo; building sand and gravel was prepared by Aldape Sand & Gravel Co. and other producers. Border Construction Co. quarried and crushed limestone for use as concrete aggregate and roadstone.

Wharton.—The mineral production valued at $62 million was 2 percent greater than that of 1958. Sulfur was mined by the Frasch process at the Boling Dome by Texas Gulf Sulphur Co. Two oilfields were discovered through exploratory drilling: Hutchins/3950 Sand and Magnet Withers, North/5700 Frio. Withers, North and Magnet Withers oilfields each produced in excess of 1 million barrels of crude oil. Paving sand and gravel was prepared for Wharton County Highway Department and for District 13 of the Texas Highway Department. Tidewater Oil Co. recovered natural-gas liquids at its West Bernard gasoline plant.

Wheeler.—Mineral fuels production, valued at $8.8 million, was 35 percent greater than in 1958. Panhandle Wheeler oilfield produced more than 1 million barrels of crude oil. Warren Petroleum Co.

recovered natural-gas liquids at its McLean-28 gasoline plant. Carbon black was recovered from natural gas and natural-gas liquids at the Norrick furnace plant of United Carbon Co., Inc.

Wichita.—Mineral production was valued at $33.3 million, 11 percent greater than in 1958. Two oilfields, K–M–A and Wichita County Regular, each produced in excess of 3 million barrels of crude oil. The Wichita Falls refineries of American Petrofina, Inc., and Continental Oil Co. refined crude oil. Natural-gas liquids were recovered at four gasoline plants. Limestone was quarried and crushed for concrete aggregate, and roadstone and paving sand and gravel was prepared by contractors for District 3 of the Texas Highway Department. Building and paving sand and gravel were prepared by Gravel, Inc., and Northwest Materials Co.

Wilbarger.—Crude oil, and sand and gravel output declined 7 percent in value to $18.2 million compared with 1958. Contractors prepared paving sand and gravel for District 3 of the Texas Highway Department. Three oilfields, Ancell/Ellenburger, Billie Jo/Palo Pinto, and the K & S/Dyson, were discovered. Wilbarger County Regular oilfield produced in excess of 3 million barrels of crude oil. Contractors prepared paving gravel for District 3 of the Texas Highway Department.

Willacy.—Crude oil and natural gas produced in Willacy County amounted to $6 million, 8 percent less than 1958. Two new oilfields, Chess/6400 Sand and LaSera/3500 Sand, were discovered.

Williamson.—The mineral production value was 41 percent greater than in 1958. Leander Limestone Corp. expanded and modified its building stone facilities at a cost of $130,000. Limestone was quarried and prepared for use in manufacturing lime by Round Rock White Lime Co. The lime was used principally for chemical and industrial purposes and building plaster. Rough architectural and dressed building stone were quarried and prepared by Leander Limestone Corp., Texas Quarries, Inc., and San-Tex Stone Quarry, Inc. Limestone was quarried and crushed by Round Rock White Lime Co., Superior Stone Products Co., Inc., Texas Carbonate Co., and Texas Crushed Stone Co. for use as concrete aggregate and roadstone, whiting, fertilizer filler, and other industrial uses.

Wilson.—Mineral production declined 29 percent in value to $2 million, compared with 1958. Fire clay, used in the manufacture of heavy clay products, was mined from open pits near Saspamco by W. S. Dickey Clay Manufacturing Co. The Weaver and Olson/Poth oilfield was proved.

Winkler.—The mineral output value of $79.8 million was 20 percent greater than that of 1958. Two new oilfields, Leck, West/Tansill-Yates and Paladin/Clearfork, were proved. Six oilfields that produced in excess of 1 million barrels of crude oil each were: Emperor, Hendrick, Kermit, Keystone/Colby Sand, Keystone/Ellenburger, and Scarborough. Cabot Carbon Co. recovered carbon black from natural gas at its Kermit furnace plant. Five gasoline plants recovered natural-gas liquids. Sulfur was recovered at the Keystone plant of Sid Richardson Gasoline Co.

Wise.—The mineral production value of $26.4 million was 52 percent greater than in 1958. Exploratory drilling proved 14 new oilfields and oil pays. Warren Petroleum Corp. (CM–M Gas Products Division) increased the gas-processing capacity of its Bridgeport gasoline plant to 150 million cubic feet a day. Natural-gas liquids were recovered at four gasoline plants. Miscellaneous clay used in the manufacture of heavy clay products was mined from open pits near Bridgeport by Acme Brick Co. Limestone was quarried and prepared for concrete aggregate and roadstone by Bridgeport Stone Co., Gifford-Hill Co., Inc., Southwest Stone Co., and Wesco Stone Corp. Contractors quarried and crushed limestone for concrete aggregate and roadstone for District 2 of the Texas Highway Department.

Wood.—Mineral fuel production, valued at $50.9 million, was 2 percent less than in 1958. Nine new oilfields and oil pays were discovered. Quitman oilfield produced more than 1 million barrels of crude oil. Natural-gas liquids were recovered at the Kaska gasoline plant of Kaska Corp. and the Hawkins gasoline plant of Natural Gasoline Corp.

Yoakum.—The mineral production value of $38.9 million was 25 percent less than the 1958 value. Three oilfields, Fitzgerald/Wolfcamp, Hartley/San Andres, and Ownby/Clearfork Upper, were discovered. Prentice, Prentice/6700, and Brahaney oilfields each produced more than 1 million barrels of crude oil. Natural-gas liquids were recovered at the Wasson gasoline plant of Shell Oil Co. and the Prentice plant of Honolulu Oil Corp. Frontier Chemical Co. recovered salt in brine from wells near Denver City.

Young.—Mineral production, valued at $19.9 million, was 8 percent under the 1958 value. Nine new oilfields and oil pays were discovered during the year. Young County Regular oilfield produced in excess of 2 million barrels of crude oil. Four gasoline plants recovered natural-gas liquids during the year. Crude oil was processed at the Graham refinery of Gratext Corp. Building and paving sand and gravel were prepared by Pitcock Bros. and by contractors for District 3 of the Texas Highway Department. Contractors also quarried and crushed limestone for concrete aggregate and roadstone for District 3 of the Texas Highway Department.

Zapata.—Mineral output increased 9 percent in value over that of 1958, to $2.4 million. Crude oil and natural gas were produced.

Zavala.—The output value of crude oil and natural gas amounted to $794,000, 65 percent greater than in 1958. Batesville, South/San Miguel oilfield was discovered.

The Mineral Industry of Utah

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Utah Geological and Mineralogical Survey.

By William H. Kerns,[1] F. J. Kelly,[1] and D. H. Mullen [1]

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SIGNIFICANT declines in the production of metals and nonmetals in Utah in 1959 were offset by a substantial gain in mineral fuels. Metals decreased $23.6 million and nonmetals $17.1 million in value. Mineral fuels, on the other hand, rose $46.5 million, resulting in an overall $5.8 million increase in the total value of mineral production in the State.

Metals output valued at $187.5 million accounted for half of the State's total value of mineral production in 1959, 11 percent below the 1958 figure. This decline resulted primarily from inactivity at the State's leading copper and iron mines because of labor strikes. In mid-August a strike idled the mine, mill, smelter, and refinery of the Utah Copper Division, Kennecott Copper Corp., and the smelter operations of International Smelting and Refining Co., subsidiary of The Anaconda Co. Operations resumed on a limited basis in late December after part settlement of differences. Principally because of this inactivity, copper output declined 44,000 tons and $10.7 million; and gold, silver, and molybdenum, recovered primarily as a byproduct of copper mining, dropped $2.4 million, $1.4 million, $1.2 million, respectively. Output of lead, zinc, and uranium decreased more than $1 million each.

A nationwide strike of steelworkers in July idled the steel mills and mines in Utah until November. Because of this strike, the value of iron ore production by Columbia Iron Mining Co., The Colorado Fuel and Iron Corp., Utah Construction and Mining Co., and others dropped $5.2 million in 1959, compared with 1958.

Mineral fuels valued at $158.8 million supplied 43 percent of Utah's total value of mineral production in 1959, an increase of 41 percent ($46.5 million) over 1958. This increase resulted mainly from a $40.5 million gain in the value of petroleum produced through extensive development of the Greater Aneth fields in San Juan County, and a full years' operation of the crude-oil pipelines from these fields to California and Gulf Coast refineries. The value of asphalt and related bitumens (gilsonite) from Uintah County (produced primarily by the major operator, American Gilsonite Co.) increased $4.5 million, and the value of natural-gas sales and natural-gas liquids increased $1.8 million and $1.4 million, respectively, as a result of the operation of a new plant in the Aneth area by El Paso Natural Gas Co. The value of coal output declined $2.4 million because of the reduced demand at steel mills.

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Nonmetals were valued at $26.7 million and represented 7 percent of the total value of mineral production in 1959, 39 percent less than in 1958. Decreases of $8 million in the value of sand and gravel production and $10 million in the value of stone output resulted from completion of the fill for the railroad causeway across the Great Salt Lake.

Highlights of new developments and plants in the mineral industry of Utah in 1959 were completion of the $11 million, 18,000-foot haulage tunnel at the Utah Copper mine to reduce haulage costs, announcement that the $16 million addition to the powerplant at this division was 95 percent completed at yearend, completion of an 8-million-cubic-yard waste-stripping contract at the Utah Copper pit, and awarding a contract to engineer major portions of a $10 million improvement and modification program at Kennecott's Garfield copper smelter, purchased in 1958. Minerals Engineering Co. purchased the 50-percent interest in the Salt Lake Tungsten Co. held by Sylvania Electric Products Corp., and became the sole owner of the refinery at Salt Lake City. The company announced that the refinery would be reactivated to produce a high-purity ammonium paratungstate. Calera Mining Co., subsidiary of Howe Sound Co., closed its cobalt refinery at Garfield upon fulfillment of purchase contracts to the General Services Administration (GSA) for cobalt. The uranium mill at Monticello, built by the Atomic Energy Commission (AEC) and operated by National Lead Co., Inc., was closed at yearend because of lack of ore. American Gilsonite Co. continued to improve its hydraulic mining and transportation methods for gilsonite. Portland Cement Co. of Utah began an expansion and renovation program at its Salt Lake City cement plant to increase production capacity to 1 million barrels of cement annually. Flintkote Co., which acquired the Utah Lime and Stone Co. in 1958, nearly completed a lime plant near Dolomite by yearend. San Francisco Chemical Co. engaged in extensive exploration and development activities of a phosphate-rock deposit north of Vernal, purchased 15,000 acres of ground on which the deposit was located, and announced plans for construction of a concentrating plant (capacity of 200,000 tons per year) near Vernal. Negotiations were completed during the year between Delhi-Taylor Oil Corp. and Texas Gulf Sulphur Co. for the development of the Cane Creek anticline potash deposits.

Employment and Injuries.—Annual average employment in the mining industry declined 10 percent, and that of metal mining alone, 7 percent, whereas total nonagricultural employment increased 5 percent. Employment in the mining industry for January through July remained constant and averaged 14,580 per month. Employment dropped to 12,940 in August and 8,370 in September, and averaged 9,650 each month during the last quarter of the year, reflecting the labor strikes in the copper and iron-ore mining and processing industries. These data were based on figures compiled by the U.S. Department of Labor, Bureau of Labor Statistics, and the Industrial Commission of Utah, Department of Employment Security.

Legislation and Government Programs.—One contract was executed in Utah between the Office of Mineral Exploration (OME) and Glen Larsen, for exploration for lead and zinc in the Iron Blossom mine in

Juab County. The contract was for $43,926 with 50-percent government participation. Work was continued on the Defense Minerals Exploration Administration (DMEA) contract executed in 1958 for exploration for lead-zinc-copper at the Mayflower-Galena mine in Wasatch County.

All manganese ore and concentrate produced in Utah in 1959 was shipped under the Government carlot-purchase program administered by GSA. The program came to a close when the quota of purchases for the National Stockpile was reached August 5. With the termination of the Government fluorspar purchase program at the end of 1958, most of the fluorspar mines in the vicinity of Delta were shut down for lack of a market, and only a small quantity of fluorspar was produced in 1959.

TABLE 1.—Mineral production in Utah[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Asphalt and related bitumens, native: Gilsonite	317,280	$4,864	379,362	$9,385
Carbon dioxide thousand cubic feet	90,207	6	69,625	5
Clays [2] thousand short tons	157	488	185	484
Coal do	5,328	30,340	4,545	27,982
Copper (recoverable content of ores, etc.)	189,184	99,511	144,715	88,855
Fluorspar	16,109	564	(3)	(3)
Gem stones	(4)	40	(4)	134
Gold (recoverable content of ores, etc.) troy ounces	307,824	10,774	239,517	8,383
Iron ore (usable) thousand long tons, gross weight	3,514	25,202	2,842	19,979
Lead (recoverable content of ores, etc.)	40,355	9,443	36,630	8,425
Lime thousand short tons	80	1,513	90	1,773
Manganese ore and concentrate (35 percent or more Mn) gross weight	[5] 1,043	[5] 84	1,511	124
Mica (sheet) pounds	12	(6)	-----------	-----------
Natural gas million cubic feet	19,247	2,829	[7] 31,000	[7] 4,600
Natural-gas liquids:				
Natural gasoline thousand gallons	240	15	(3)	(3)
LP-gases do	-----------	-----------	(3)	(3)
Petroleum (crude) thousand 42-gallon barrels	24,811	74,185	[7] 40,109	[7] 114,712
Pumice thousand short tons	41	84	39	81
Salt (common) do	184	2,275	209	2,453
Sand and gravel do	25,304	14,379	8,843	6,436
Silver (recoverable content of ores, etc.) thousand troy ounces	5,278	4,777	3,734	3,380
Stone thousand short tons	13,126	13,949	3,338	4,048
Uranium ore	1,239,767	38,583	1,210,654	37,310
Vanadium thousand pounds	752	(3)	1,072	(3)
Zinc (recoverable content of ores, etc.)	44,982	9,176	35,223	8,101
Value of items that cannot be disclosed: Barite (1959), cement, clay (kaolin), gypsum, molybdenum, perlite, phosphate rock, potassium salts, pyrites (1959), and values indicated by footnote 3	-----------	[8] 25,214	-----------	27,396
Total Utah [9]	-----------	[8] 367,232	-----------	373,017

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; value included with "Items that cannot be disclosed."

[3] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

[4] Weight not recorded.

[5] Excludes shipments to Government purchase depot under the "low grade" program; quantity and value for this manganese ore and concentrate (which includes material of 5 to 35 percent Mn content) are as follows: 1,211 short tons, $49,357.

[6] Less than $1,000.

[7] Preliminary figure.

[8] Revised figure.

[9] Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

TABLE 2.—Employment data in mining and other industries related to mining

[United States Department of Labor, Bureau of Labor Statistics, and the Industrial Commission of Utah Department of Employment Security]

Industry	Annual average employment		Percent of total nonagricultural		Average hourly earnings		Average weekly hours		Average weekly earnings	
	1958[1]	1959	1958[1]	1959	1958	1959	1958	1959	1958	1959
Mining	14,100	12,700	5.8	5.0	$2.61	$2.74	39.1	40.1	$102.50	$109.75
Metal mining	8,100	7,500	3.4	3.0	2.45	2.56	41.3	41.2	101.18	105.50
Bituminous coal mining	3,000	2,500	1.2	1.0	3.08	3.24	32.1	33.6	98.87	108.89
Manufacturing	38,900	42,400	16.1	16.8	2.29	2.34	39.4	40.0	90.23	93.60
Contract construction	14,900	16,400	6.2	6.5	2.95	3.00	41.0	38.8	120.95	116.34
Total nonagricultural	241,700	252,700	100.0	100.0	(2)	(2)	(2)	(2)	(2)	(2)

[1] Revised figures.
[2] Data not available.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Exploration for beryllium bearing ores assumed major importance in 1959. Development of a nuclear device (berylometer) for detecting low-grade disseminated nonpegmatitic beryllium occurrences stimulated large-scale prospecting for this mineral. The Sheeprock and Topaz Mountains were two of the more important areas being prospected.

Cobalt.—Calera Mining Co., subsidiary of Howe Sound Co., closed its cobalt refinery at Garfield in September with the fulfillment of government purchase contracts for cobalt. The company mining and milling operation at Cobalt, Idaho, which furnished cobalt concentrate to the refinery, also was closed.

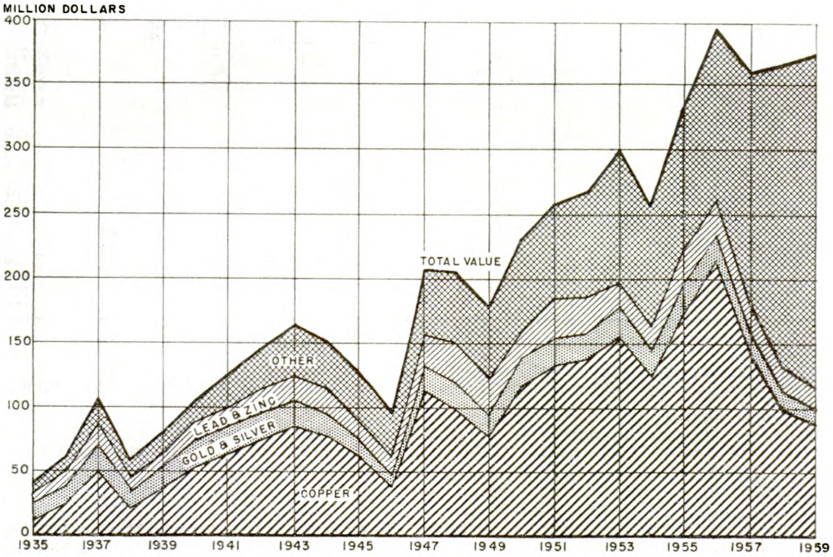

FIGURE 1.—Value of gold, silver, copper, lead, and zinc, and total value of all minerals in Utah, 1935–59.

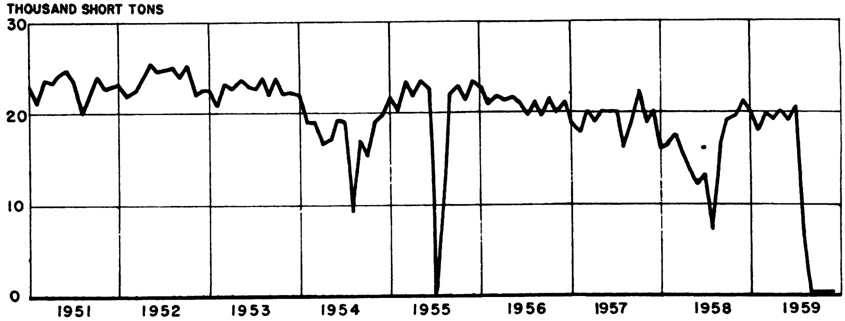

FIGURE 2.—Mine production of copper in Utah, 1951–59, by months, in terms of recoverable metals.

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950–54 (average)	68	1	30,324	442,421	$15,485	6,899	$6,244
1955	63	----------	28,599	441,206	15,442	6,251	5,657
1956	91	----------	33,232	416,031	14,561	6,572	5,948
1957	76	1	31,722	378,438	13,245	6,198	5,610
1958	61	2	24,871	307,824	10,774	5,278	4,777
1959	30	----------	20,221	239,517	8,383	3,734	3,380
1864–1959	----------	----------	[3] 937,983	15,742,241	451,204	804,249	601,085

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950–54 (average)	262,788	$132,742	46,382	$13,782	32,431	$9,298	$177,551
1955	232,949	173,780	50,452	15,035	43,556	10,715	220,629
1956	250,604	213,013	49,555	15,560	42,374	11,611	260,693
1957	237,857	143,190	44,471	12,719	40,846	9,476	184,240
1958	189,184	99,511	40,355	9,443	44,982	9,176	133,681
1959	144,715	88,855	36,630	8,425	35,223	8,101	117,144
1864–1959	7,960,476	3,042,629	5,031,131	670,461	1,477,982	265,231	5,030,610

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings, or slimes re-treated; and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.

[2] Does not include gravel washed or tonnage of precipitates shipped.

[3] Figures estimated for certain years before 1901.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc in 1959, by counties, in terms of recoverable metals

County	Mines producing (lode) [1]	Lode material sold or treated [2] (short tons)	Gold		Silver	
			Troy ounces	Value	Troy ounces	Value
Beaver	1	800	23	$805	1,832	$1,658
Juab	3	2,647	73	2,555	8,377	7,582
Piute	(3)	(3)	(3)	(3)	(3)	(3)
Salt Lake	8	20,063,724	232,803	8,148,105	2,978,316	2,695,526
San Juan	[3] 2	[3] 114	[3] 8	[3] 280	[3] 8,391	[3] 7,594
Sevier	1	6	3	105	384	348
Summit	4	103,151	1,478	51,730	557,928	504,953
Tooele	5	1,750	129	4,515	4,270	3,865
Utah	4	3,389	136	4,760	7,494	6,782
Wasatch	1	45,126	4,864	170,240	167,305	151,419
Washington	1	215	----------	----------	----------	----------
Total:						
1959	30	20,220,922	239,517	8,383,095	3,734,297	3,379,727
1958	63	24,871,355	307,824	10,773,840	5,277,693	4,776,579

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaver	7	$4,421	5	$1,081	23	$5,210	$13,175
Juab	17	10,162	158	36,271	77	17,768	74,338
Piute	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Salt Lake	143,927	88,370,994	27,964	6,431,732	24,508	5,636,828	111,283,185
San Juan	[3] 560	[3] 343,686	(4)	[3] 92	[3] 5	[3] 1,276	[3] 352,928
Sevier	----------	----------	----------	----------	----------	----------	453
Summit	13	7,982	5,186	1,192,792	7,297	1,678,298	3,435,755
Tooele	4	2,579	90	20,838	82	18,791	50,588
Utah	5	3,162	45	10,315	12	2,691	27,710
Wasatch	148	91,117	3,182	731,779	3,219	740,347	1,884,902
Washington	34	20,907	----------	----------	(4)	81	20,988
Total:							
1959	144,715	88,855,010	36,630	8,424,900	35,223	8,101,290	117,144,022
1958	189,184	99,510,784	40,355	9,443,070	44,982	9,176,328	133,680,601

[1] Operations at slag dumps and old mill or miscellaneous cleanups not counted as producing mines; various uranium mines from which copper was recovered as a byproduct not included as were in the mine count of uranium.

[2] Excludes tonnage of copper precipitates shipped.

[3] Piute and San Juan Counties combined to avoid disclosing individual company confidential data.

[4] Less than 1 ton.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold-silver	5	38,877	372	19,041	573,400	666,700	331,300
Dry silver	3	3.117	34	7,865	25,900	200	200
Total	8	41,994	406	26,906	599,300	666,900	331,500
Copper and uranium[2]	[3] 3	[4] 19,673,423	223,662	1,792,737	278,122,200	500	11,500
Copper-lead-zinc	2	193	1	5,257	11,200	25,800	22,700
Copper-zinc	1	800	23	1,832	14,400	9,400	45,300
Lead	10	2,042	183	16,947	13,000	424,000	57,000
Lead-zinc	9	467,998	15,167	1,876,169	2,695,500	71,425,400	66,173,200
Total	21	20,144,456	239,036	3,692,942	280,856,300	71,885,100	66,309,700
Other "lode" material:							
Copper cleanings	(5)	329	50	6,497	166,200	14,000	----------
Copper precipitates	2	5,151	----------	----------	7,770,800	----------	----------
Copper-lead cleanings	(5)	67	18	1,293	5,200	30,500	1,600
Lead-zinc cleanings	(5)	101	1	555	100	10,600	14,600
Lead-zinc tailings	1	300	1	205	100	1,700	5,000
Zinc slag	(5)	33,675	5	5,899	32,000	651,200	3,783,600
Total	3	39,623	75	14,449	7,974,400	708,000	3,804,800
Total "lode" material	30	20,226,073	239,517	3,734,297	289,430,000	73,260,000	70,446,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Copper mines only; excludes the mine count of uranium mines from which copper was recovered as a byproduct.
[4] Excludes uranium-ore tonnage.
[5] From properties not classed as mines.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1959, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Concentration, and smelting of concentrates:					
Ore[1]	238,844	3,675,580	280,772,100	71,460,500	66,157,900
Cleanings	1	555	100	10,600	14,600
Old tailings	1	205	100	1,700	5,000
Total	238,846	3,676,340	280,772,300	71,472,800	66,177,500
Direct-smelting:					
Ore	598	44,268	683,500	1,091,500	483,300
Cleanings	68	7,790	171,400	44,500	1,600
Copper precipitates	----------	----------	7,770,800	----------	----------
Old slag	5	5,899	32,000	651,200	3,783,600
Total	671	57,957	8,657,700	1,787,200	4,268,500
Grand total	239,517	3,734,297	289,430,000	73,260,000	70,446,000

[1] Includes uranium-ore concentrate.

Copper.—Copper production decreased 24 percent in quantity and 11 percent in value compared with 1958, but Utah continued to rank second among all States in copper output. The value of copper production accounted for 47 percent ($89 million) of the total value of metals output ($188 million) and 24 percent of the State's total value of all minerals produced. Production of copper averaged 19,600 tons per month for the first 7 months of the year, fell to 6,700 tons in August, and then averaged only 146 tons per month for the last 4 months of the year. These monthly production figures illustrate the effect of the mid-August strike on the operating companies. The strike idled the mine, mill, smelter, and refinery of the Utah Copper Division, Kennecott Copper Corp., the State's leading copper producer. In its annual report for 1959 Kennecott stated that copper production from all sources at the Utah Copper Division mine in Salt Lake County was 142,352 tons, compared with 186,631 tons in 1958. Ore mined and milled was 19.7 million and 24.1 million tons, respectively. Copper content of ore mined was 16.3 pounds per ton in 1959—0.2 pounds per ton below the average for 1958. The company announced that the $16 million addition to the powerplant at this division, which was 95 percent completed at yearend, would increase output from 100,000 to 175,000 kilowatts, enough power to meet the residential requirements of a city of 87,500 typical homes.

The $11 million, 18,000-foot haulage tunnel at the Bingham mine of the Utah Copper Division was completed by the contractor, Utah Construction & Mining Co. This tunnel was built to eliminate hauling ore from the lower levels of the mine for considerable distances upgrade, thereby reducing haulage costs from mine to mill. Work on this project was begun October 1956 and completed 9 months ahead of schedule.[2] Western Contracting Corp. completed a stripping contract for the removal of 8 million cubic yards of waste from the upper east and west sides of Kennecott's Bingham pit. Western Knapp Engineering Co. received a contract to engineer major portions of a $10 million improvement and modification program at Kennecott's copper smelter at Garfield, purchased in 1958 from the American Smelting and Refining Co.

The U.S. and Lark mine of the United States Smelting Refining and Mining Co., second-ranking Utah copper producer, operated throughout the year on an alternate 5- and 6-day-week basis; the Lark section operated 2 shifts per day, and the U.S. section day shift only, except for development work. According to the company report for 1959, overall grade of ore and tonnage produced from the U.S. and Lark mine in Salt Lake County was slightly below comparable figures for 1958. The ore mined was treated in the company's Midvale mill, which operated on an alternate 5- and 6-day-week basis. In addition to Utah Copper and the U.S. and Lark mines, copper was reported produced from the 5 mines in Salt Lake County and 19 mines in Juab, Piute, San Juan, Summit, Tooele, Utah, Wasatch, and Washington Counties.

Gold.—Gold output dropped 22 percent ($2.4 million) compared with 1958. This decline directly reflected the reduction in copper output because of the strike, since gold was recovered primarily as a byproduct of copper mining.

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[2] Mining World, Utah Sets Record at Bingham Canyon: Vol. 21, No. 2, February 1959, pp. 37–39.

Kennecott's Utah Copper Bingham open-pit copper mine, accounted for most of State gold output. Other major gold producers included U.S. and Lark, Mayflower-Galena, and United Park City mines.

Iron Ore.—Shipments of iron ore were 19 percent less than in 1958, and their value declined 21 percent, or $5.2 million. This reduction in output was caused by a strike of steelworkers, which began July 15 and ended November 7. Ore shipments for the year totaled 672,000 tons. Iron-ore output came principally from Iron County, where production was reported from nine mines; shipments also were reported from one mine each in Beaver and Juab Counties.

Four companies accounted for iron-ore shipments from Iron County. The Columbia Iron Mining Co., a subsidiary of United States Steel Corp., shipped ore from the Desert Mound and Iron Mountain mines to blast and open-hearth furnaces at the Columbia-Geneva Steel Division, United States Steel Corp. in Geneva and Ironton. This was the State's largest iron-ore producer. The Colorado Fuel and Iron Corp. shipped iron ore—mined under contract by Utah Construction & Mining Co., from the Blowout, Comstock, and Duncan mines—to its plant at Pueblo, Colo., for making pig iron and steel. The Utah Construction & Mining Co. shipped iron ore from the Excelsior mine to consumers in Utah and California. Helene E. Beatty shipped iron ore (float material) from several lease claims to various eastern and western markets.

Management & Engineer shipped a small quantity of magnetite from the Montreal mine in Beaver County to the Teller Construction Co., Scoville, Idaho, for use as heavy aggregate in concrete. Lynn Mining Co. produced and marketed a substantial quantity of brown iron ore from the Iron Blossom mine in Juab County for use in the production of dead-burned dolomite.

TABLE 7.—Shipments of usable iron ore

Year	Thousand long tons	Value (thousands)	Year	Thousand long tons	Value (thousands)
1950–54 (average)	3,379	$15,338	1958	3,514	$25,202
1955	3,347	24,687	1959	2,842	19,979
1956	4,002	27,508			
1957	4,156	30,383	1906–59	57,164	232,913

Lead.—Production of lead decreased 9 percent, but its value declined 11 percent because of a drop of 0.2 cents in the weighted annual average price to 11.5 cents a pound.

The U.S. and Lark mine at Bingham, operated by the United States Smelting Refining and Mining Co., was again the leading lead producer, followed by United Park City and Mayflower-Galena mines. These three operations supplied 96 percent of State lead output.

Cerro de Pasco Corp., in joint venture with Armet Co. and Chief Consolidated Mining Co., conducted exploration work for silver-bearing lead ore at the Holt silver mine near Enterprise in Iron County.

Chief Consolidated Mining Co. and Shattuck Denn Mining Corp. reached an agreement to merge the two firms. Bear Creek Mining Co., a subsidiary of the Kennecott Copper Corp., explored the Tintic property, owned by Chief Consolidated, completed 2,040 feet of underground drifting and crosscutting and 7,970 feet of diamond drilling. They reportedly developed a sizable deposit of silver-bearing lead-zinc ore.

Manganese Ore and Concentrate.—Manganese ore and concentrate production in the State was shipped to the Government under the carlot program administered by GSA. It came from nine mines—five in Grand, three in Juab, and one in Rich Counties. The material shipped averaged 41.9 percent manganese, and was worth $82 per short wet ton. Gene F. Tom, Minerals of Utah, Lloyd W. Smith, and Fred Staats were the principal producers, in order of decreasing output.

Molybdenum.—The Utah Copper mine of the Utah Copper Division, Kennecott Copper Corp., continued to be the only Utah producer of molybdenum. The molybdenum was recovered as a molybdenite concentrate, by flotation as a byproduct of copper concentrate. It was produced from Utah Copper ore, at the Arthur and Magna mills.

Silver.—Silver production declined 1.5 million troy ounces (29 percent) principally because of significant drops in output from the State's leading silver producers, Utah Copper, U.S. and Lark, and United Park City mines. These mines supplied 94 percent of the output in 1959. Fifty percent of the silver was recovered from material classed as lead-zinc ores; 48 percent from copper ores; and the remainder from combined ores of copper, lead, zinc, gold and silver, and miscellaneous materials.

Thorium.—A number of mining firms were engaged in laboratory and small pilot-scale experiments on thorium in 1959. Ore from the Lemhi Pass area of Idaho was being investigated by Rare Metals of America, of Salt Lake City.

Tungsten.—There was no recorded production of tungsten ore in Utah in 1959. Minerals Engineering Co. purchased the 50-percent interest in Salt Lake Tungsten Co. held by Sylvania Electric Products Corp. and became the sole owner of the refinery at Salt Lake City. It was announced that the refinery, which was closed in January 1958, would be reactivated to produce a high-purity ammonium paratungstate from concentrate produced from the company's Calvert Creek open-pit mine and mill near Dillon, Mont., and concentrate purchased from independent operations. It was also announced in September that the company was producing 2 to 5 tons per day of paratungstate at its Salt Lake City refinery on a pilot-plant basis.

Uranium.—Production of uranium ore from 318 operations in 11 counties declined 2 percent compared with 1958, when production was reported from 392 operations. The grade of ore produced remained at 0.36 percent or 7.2 pounds of uranium oxide per ton. The greatest production continued to be from San Juan County followed by Emery and Grand Counties. Although four processing mills operated throughout the year, the one at Monticello, built by AEC and operated by National Lead Co., Inc., was closed December 31, 1959, because continued operation would necessitate the purchase of a substantial quantity of ore in excess of programmed requirements by AEC. The concentrate purchase contract between Uranium Reduction Co. at Moab and AEC was amended to extend it through December 31, 1966. Texas-Zinc Minerals Corp. operated its 1,000-ton mill at Mexican Hat, and Vitro Chemical Co. operated its 600-ton plant at Salt Lake City. The upgrading plant at Green River, operated by Union Carbide Nuclear Co., processed crude ore for further treatment at the Rifle (Colo.) plant.

TABLE 8.—Mine production of uranium ore [1]

County	1958				1959			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Beaver	4	2,340	7,753	$26,200	2	(3)	(3)	(3)
Emery	67	66,941	322,604	1,319,391	47	67,667	321,705	$1,316,497
Garfield	42	1,606	19,169	87,527	41	1,789	27,998	130,740
Grand	61	35,138	214,641	909,321	51	41,197	219,522	913,702
Iron	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Juab	1	(3)	(3)	(3)	1	15,519	72,463	292,533
Piute	4	(3)	(3)	(3)	4	(3)	(3)	(3)
San Juan	196	1,109,448	8,239,554	35,801,208	167	1,068,787	7,901,726	34,452,053
Sevier	1	(3)	(3)	(3)	1	(3)	(3)	(3)
Washington	1	(3)	(3)	(3)	----------	----------	----------	----------
Wayne	14	528	3,056	12,620	3	(3)	(3)	(3)
Undistributed	----------	23,766	107,095	426,415	----------	15,695	56,902	204,927
Total	392	1,239,767	8,913,872	38,582,682	318	1,210,654	8,600,316	37,310,452

[1] Based on data supplied to the Bureau of Mines by the AEC.

[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Reserve of uranium ore in Utah December 31, 1959, as estimated by AEC, was 5.3 million tons containing 0.33 percent (6.6 pounds per ton) uranium oxide. This compared with a similar estimate (as of December 31, 1958) of 5.6 million tons containing 0.35 percent (7.0 pounds per ton) uranium oxide. The Federal Geological Survey published several reports on uranium resources in Utah.[3]

Vanadium.—Uranium ore containing enough vanadium to warrant the cost of recovery was processed at mills in southwestern Colorado for recovery of both vanadium and uranium. The quantity of vanadium recovered from Utah ores increased 43 percent, compared with 1958.

Zinc.—Zinc output declined 22 percent (10,000 tons) in quantity but only 12 percent in value ($1.1 million), because the weighted annual average price increased 1.3 cents per pound to 11.5 cents. Output dropped in 1959 from U.S. and Lark, United Park City, and Mayflower-Galena mines, the State's leading zinc producers. These mines accounted for 93 percent of State zinc output.

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[3] Byerly, P. Edward, and Joesting, H. R., Regional Geophysical Investigations of the Lisbon Valley Area, Utah and Colorado: Geol. Survey Prof. Paper 316-C, 1959, pp. 39-50.
Johnson, Henry S., Jr., Uranium Resources of the Green River and Henry Mountain Districts, Utah, A Regional Synthesis; Geol. Survey Bull. 1087-C, 1959, pp. 59-104.
Finch, W. I., Geology of Uranium Deposits in Triassic Rocks of the Colorado Plateau Region; Geol. Survey Bull. 1074-D, 1959, pp. 125-164.

MINERAL FUELS

Asphalt and Related Bitumens.—Production of gilsonite (uintahite) from five mines in Uintah County increased $4.5 million in value, compared with 1958. The major producer, American Gilsonite Co., continued to improve its mining operations and increased the quantity of material transported by pipeline to the processing plant in Colorado by raising the gilsonite content in the slurry from 35 to 45 percent. The increase was accomplished with the same pump capacity.

Carbon Dioxide.—Carbon-dioxide production from the Farnham Dome field in Carbon County declined 23 percent, compared with 1958. The gas was transported by pipeline to Wellington, where it was converted into dry ice by the Carbon Dioxide & Chemical Co.

Coal.—Production of coal from 46 underground mines in 6 counties producing 1,000 tons or more was 15 percent below that of 1958. The steel strike during the latter part of the year accounted for much of the decline. Coal from captive mines, used for manufacturing coke for steel plants in Utah and California, accounted for 48 percent of the total. Six cleaning plants were operated, and 66 percent of all coal sold was cleaned—54 percent by jigs, 3 percent by pneumatic methods, and 43 percent by wet methods other than jigs. Of the total coal produced, 36 percent was oil treated to prevent dusting.

TABLE 9.—Production of coal, by counties (exclusive of mines producing less than 1,000 tons annually)

County	1958		1959	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Carbon	3,956,396	$6.09	3,446,396	$6.30
Emery	1,266,423	4.50	988,809	5.76
Garfield	1,034	5.20	----------	----------
Iron	34,714	5.24	42,393	4.91
Kane	1,291	5.20	1,300	4.91
Sevier	50,103	5.61	47,250	6.00
Summit	17,555	4.47	18,409	4.44
Total	5,327,516	5.70	4,544,557	6.16

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producers, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially).

Natural Gas.—Sales of natural gas to consumers increased 61 percent, compared with 1958. Dry natural gas was produced at 10 fields in 8 counties and residual gas by the Mountain Fuel Supply Co. at its natural-gas plant in the Clay Basin field, Daggett County. The increase in sales came from the El Paso Natural Gas Co. plant in the Aneth area; approximately 80 million cubic feet a day was being processed at yearend. Residual gas from the plant was marketed through company-owned pipelines to consumers in California and other West Coast States. Six new gasfields were discovered, three in Uintah County and one each in Carbon, Grand, and San Juan Counties. Development drilling resulted in nine producing wells, five in Grand County and four in Uintah County.

Natural-Gas Liquids.—The extraction plant of El Paso Natural Gas Co. in the Aneth field began operating in the latter half of 1959 and recovery was more than 300,000 gallons a day of natural-gas liquids, which was further processed at the company's fractionation plant at Wingate, N. Mex. Operation of this plant accounted for the great increase in natural-gas liquids—natural gasoline, butane, and propane —from Utah fields in 1959. Mountain Fuel Supply Co. recovered natural gasoline at its cycle plant in the Clay Basin field at approximately the same rate as in 1958.

Petroleum.—Production of petroleum from five counties increased 62 percent (15.3 million barrels) and its value increased 55 percent ($40.5 million) compared with 1958. Gains were recorded in all producing counties except Grand. Extensive development in the Greater Aneth area in San Juan County, where production rose from 21 million barrels in 1958 to 35 million in 1959, accounted for most of the increase. A full year's operation of crude-oil pipelines to California and Gulf Coast refineries provided the necessary outlet for the increased output. Exploratory drilling was more rewarding than in 1958; of 101 wildcat wells completed there were 6 discoveries, 4 in San Juan County. Development drilling, largely in the Aneth area in San Juan County and the Red Wash field in Uintah County, resulted in 176 oil wells and 9 gas wells from 217 wells completed. Drilling totaled 1.7 million feet; 552,200 feet was exploratory and 1.2 million feet was development. The most significant discovery was the No. 1 Northwest Lisbon, drilled by Pure Oil Co. in the northern part of the Paradox basin. The well tested as much as 587 barrels of oil a day from Devonian formation and 17.5 million cubic feet of gas a day from Mississippian formation. At yearend the well was being completed as a Devonian oil producer. A deep test in Duchesne County produced 306 barrels of oil a day from the Wasatch formation, at a depth of 11,835 to 11,895 feet.

TABLE 10.—Production of crude petroleum, by counties[1]

(Thousand barrels)

County	1958	1959 (preliminary)	Principal fields in 1959 in order of production
Duchesne	2	22	Duchesne, Starr Flat.
Grand	11	9	Big Flat, Seiber Nose.
San Juan	21,077	35,215	Aneth, McElmo Creek, Ratherford, White Mesa.
Uintah	3,720	4,859	Red Wash, Ashley Valley, Roosevelt, Brennan Bottom.
Washington	1	4	Virgin.
Total	24,811	40,109	

[1] Distribution by counties effected by use of Utah Oil & Gas Conservation Commission data, adjusted to Bureau of Mines total.

NONMETALS

Barite.—Barium, Inc., in Carbon County and D. J. Garrick in Juab County reported barite production in 1959. The crude ore was shipped to the Salt Lake City grinding plant of Metals Disintegrating Co., Inc., for processing. The finished product was used mainly as a constituent of mud used in oil-well drilling.

TABLE 11.—Wildcat- and development-well completions in 1959, by counties

[Oil and Gas Journal]

County	Crude	Gas	Dry	Total	Footage
WILDCAT					
Cache		1		1	200
Carbon		1	5	6	34,700
Duchesne	2		1	3	27,600
Emery			9	9	52,000
Garfield			3	3	14,800
Grand		1	7	8	20,900
Salt Lake			1	1	600
San Juan	4	1	38	43	256,200
Summit			1	1	1,700
Uintah	1	3	9	13	73,700
Utah			1	1	6,900
Washington			2	2	4,500
Wayne			10	10	58,400
Total	7	7	87	101	552,200
DEVELOPMENT					
Duchesne	1		1	2	5,500
Grand		5	3	8	11,200
San Juan	154		24	178	1,008,400
Uintah	19	4	4	27	158,800
Washington	2			2	1,500
Total	176	9	32	217	1,185,400
Total all drilling	183	16	119	318	1,737,600

Cement.—Output of portland and masonry cements reflected the continued growth of Utah and recorded a 4-percent gain over 1958. The four kilns of Ideal Cement Co. and Portland Cement Co. of Utah operated throughout 1959, and the bulk of the output was consumed in Utah. Portland Cement Co. of Utah began expanding and renovating its Salt Lake City plant to increase capacity from 400,000 to 1 million barrels of cement annually.

Clays.—The production of all types of clay (excluding kaolin) rose to 185,000 tons in 1959, 18 percent greater than in 1958. The value of this production declined slightly because of a substantial gain in the output of lower priced miscellaneous clay in Weber County. Production of kaolin from the Dragon mine decreased slightly from the 1958 total, as did the production of fuller's earth and bentonite from the Garfield and Sevier County deposits of American Mud & Chemical Corp. and Western Clay & Metals Co., respectively. Production of miscellaneous clay from eight operations in five counties was 10 percent greater than in 1958, as a result of a stronger demand for building brick and other heavy clay products. Output of fire clay increased to 67 percent. A new adobe brick plant was opened at Riverton by Adobe Engineering Co. The plant could produce 1,200 asphalt waterproof bricks per hour. Operation of the Dragon mine was described.[4]

Fluorspar.—Because of the termination of the U.S. Government fluorspar purchase program at the end of 1958, most of the fluorspar mines shut down for lack of a market. A small quantity of Metallurgical-grade ore produced by Willden Bros. was shipped to steel plants.

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[4] Intermountain Industry and Mining Review, Halloysite From the Dragon Mine: Vol. 61, No. 10, October 1959, pp. 36–38.

Gem Stones.—The collection of gem and ornamental stones continued to be of interest to a large number of individuals, societies, and dealers. The estimated value of the material collected was $134,000, based on reports received from persons engaged in collecting and processing these materials; the value in 1959 was 3⅓ times greater than in 1958. Juab, Garfield, and Millard Counties were credited with the highest value of stones collected. The Dugway Mountain Range in Juab County, Henry Mountains and the area around Escalante in Garfield County, and the Black Rock area and the House Range in Millard County were the principal producing regions. Petrified wood accounted for nearly half of the total value in 1959. A considerable quantity of agate was collected, along with jasper, variscite, chalcedony, and obsidian.

Gypsum.—The mining and processing of gypsum continued to be a significant source of income to the mineral industry of the State. The value of crude gypsum sold or used by producers was 21 percent greater than in 1958. Bestwall Gypsum Co. and United States Gypsum Co. operated adjacent plants near Sigurd, Sevier County. The bulk of the gypsum products was consumed in Utah, and the remainder shipped to neighboring States. United States Gypsum Co. produced some Keene's cement in addition to wallboard and other gypsum products.

Lime.—Output of lime rose to 90,000 tons, 13 percent more than in 1958. The dependence of the lime industry of the State upon the needs of the mineral industry was emphasized during the year. The copper strike reduced for a time the demand for lime produced by Kennecott Copper Corp. and the steel strike curtailed operation of the dead-burned dolomite plant of Utah Marblehead Lime Co. However, these setbacks to consumption were more than offset by larger consumption subsequent to the strikes. The Flintkote Co. acquired the Utah Lime & Stone Co.[5] and also began constructing a lime plant near Dolomite. The new plant was to be operated by Utah Lime & Stone Co. using the Corson lime hydration process. Construction was substantially completed by yearend. Lakeside Lime & Stone Co. continued to operate its Lehi limekiln throughout the year.

Mica.—No production of scrap or sheet mica was reported in 1959.

Perlite.—Crude perlite was mined by Acme Lite-Wate Products, Inc., from its Beaver County deposit and shipped to Salt Lake City for expanding. A perlite-expanding plant was operated by Bestwall Gypsum Co. at Sigurd using crude material produced in Nevada.

Phosphate Rock.—The phosphate-rock industry in Utah centered around the activities of San Francisco Chemical Co. The company mined phosphate rock from the Bradley mine at an accelerated rate for shipment to its Leefe (Wyo.) processing plant. As a result of extensive exploration and development during the year the company exercised its option to purchase a 15,000-acre phosphate-rock deposit (Humphreys deposit) 15 miles north of Vernal. Estimated reserve was 700 million tons averaging 21 percent phosphorus pentoxide (P_2O_5). San Francisco Chemical Co. prepared plans for a concentrating plant near Vernal with an annual capacity of 200,000 tons of concentrate. The company also acquired control of 15 patented phosphate claims, which assured it of sufficient reserves in the area of Leefe (Wyo.) and Randolph (Utah) for 40 years of operation at the 1959 production rate.

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[5] Pit and Quarry, Flintkote Assumes Dominant Role in Western Lime Field: Vol. 51, No. 11, May 1959, pp. 140–143.

Potash.—Increased potash shipments were reported from the Wendover plant of Bonneville, Ltd. During 1959 the company cleaned 21 miles of ditch to the original depth or deeper to accommodate more potash-bearing brine from Great Salt Lake. Also during the year Delhi-Taylor Oil Corp. and Texas Gulf Sulphur Co. completed negotiations for joint development of the Cane Creek anticline potash deposits. Details of the agreement were not available by yearend. Superior Oil Co. of California continued to develop a potash deposit in the Lisbon Valley area of northern San Juan County.

Pumice.—Scoria was mined by Christensen Construction Co., at its Red Dome claims near Fillmore, and Central Utah Block Co. produced scoria at a pit near Flowell. All 39,000 tons produced in 1959 was used in concrete aggregate and in manufacturing building blocks.

Pyrites.—Pyrite was recovered as a byproduct of lead-zinc ore from the U.S. and Lark mine and custom ore treated in the United States Smelting Refining and Mining Co. Midvale mill. The pyrite was shipped to Garfield Chemical and Manufacturing Corp. at Garfield for use in manufacturing sulfuric acid and to the American Smelting and Refining Co. Selby (Calif.) lead smelter for use as a flux.

Salt.—Shipments of salt from Utah operations rose to 209,000 tons and nearly offset the 37,000 loss reported in 1958. The Morton Salt Co., in Salt Lake County, continued to be the principal producer and operated its Saltair solar-evaporation facility throughout the year. Utah Salt Co. was the second largest producer with a plant at Wendover, which processed the salt removed from the brine ponds of Bonneville, Ltd. The company operated a drying, screening, and loading plant and completed construction of a warehouse and bagging plant in 1959. Leslie Salt Co. announced plans to renovate the ponds, harvesting, and processing equipment of the solar-evaporation facility that it purchased from Deseret Salt Co. in 1958. The first major harvest from the new salt ponds of Solar Salt Co. started late in 1959. It took 3 years to lay the 18-inch hard-salt foundation for the ponds. The facility is between Grantsville and Stansbury Island. The 10 ponds had a capacity to yield 160,000 to 200,000 tons of salt annually.

Sand and Gravel.—Completion of the fill for the railroad causeway across Great Salt Lake was largely responsible for a 65-percent decline in the production of sand and gravel in 1959. Morrison-Knudsen Co., Inc., completed this part of the overall construction project early in the year. Excluding material produced for the causeway, sand and gravel output (8.8 million tons) increased 18 percent over 1958. Salt Lake County was the largest producing region, with 15 commercial and 2 Government-and-contractor producers reporting an output of 2.3 million tons of sand and gravel. A report[6] showed that Utah ranked 29th in the Nation with 74.6 miles of construction underway on the Federal Interstate Highway System in 1959.

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[6] Bureau of Public Roads, Status of Federal-Aid Highway Programs, December 1959: Press release BPR 60-3.

TABLE 12.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Construction sand:				
Building	707	$652	778	$761
Paving	556	524	412	389
Fill	1	1	146	62
Other	7,999	4,006	43	63
Industrial sand:				
Molding	25	30	(1)	(1)
Engine	1	2	(1)	(1)
Other	----------	----------	21	27
Total sand	9,289	5,215	1,400	1,302
Construction gravel:				
Building	673	621	895	820
Paving	2,379	1,995	2,319	1,875
Railroad ballast	91	29	(1)	(1)
Fill	204	112	1,321	668
Other	9,829	4,925	80	97
Miscellaneous gravel	----------	----------	3	7
Total gravel	13,176	7,682	4,618	3,467
Total sand and gravel	22,465	12,897	6,018	4,769
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	----------	----------	5	17
Paving	369	87	15	9
Fill	----------	----------	9	4
Total sand	369	87	29	30
Gravel:				
Building	46	63	216	147
Paving	2,424	1,332	2,580	1,490
Total gravel	2,470	1,395	2,796	1,637
Total sand and gravel	2,839	1,482	2,825	1,667
ALL OPERATIONS				
Sand	9,658	5,302	1,429	1,332
Gravel	15,646	9,077	7,414	5,104
Grand total	25,304	14,379	8,843	6,436

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other."

Stone.—The temporary surge of stone production (1957–58) resulting from requirements for the railroad causeway across Great Salt Lake ended in 1959. (See sand and gravel). Completion of construction work on Federal Bureau of Reclamation projects reduced the quantity of crushed granite, limestone, and sandstone quarried, thereby further reducing the total stone produced in 1959. The demand for crushed limestone for cement and lime manufacture continued to be the principal market for stone.

TABLE 13.—Production of stone in 1959, by counties

County	Short tons	Value	County	Short tons	Value
Box Elder	2,024,500	$2,024,500	Summit	759	$20,000
Cache	47,100	162,400	Tooele	215,000	463,100
Daggett	5,000	10,000	Utah	(1)	(1)
Iron	900	10,800	Washington	(1)	(1)
Juab	(1)	(1)	Weber	1,000	1,000
Morgan	(1)	(1)	Other counties	1,039,327	1,335,208
Salt Lake	(1)	(1)			
Sanpete	4,300	21,400	Total	3,337,886	4,048,408

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other counties."

TABLE 14.—Stone sold or used by producers, by kinds

Year	Granite		Limestone		Sandstone		Other stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1955			1,444,517	$2,149,799	218,551	$359,331	262,799	$141,350	1,925,867	$2,650,480
1956			1,694,217	2,563,741	321,588	430,101	305,831	304,164	2,321,636	3,298,006
1957			1,723,300	2,359,600	123,175	155,150	6,007,400	6,025,300	7,853,875	8,540,050
1958	77,300	$146,100	2,958,000	3,648,900	10,090,877	10,153,414	200	200	13,126,377	13,948,614
1959	1,500	1,500	1,547,600	2,196,400	1,786,186	1,834,808	2,600	15,700	3,337,886	4,048,408

TABLE 15.—Stone sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Dimension stone:[1]	1,477	$33,914	1,186	$29,808
Crushed and broken stone:				
Riprap	81,600	155,800	2,500	2,500
Metallurgical	571,700	706,300	411,500	669,500
Concrete and roadstone	122,300	145,800	10,000	13,700
Chemical	59,900	236,600	49,800	169,100
Miscellaneous	[2]12,289,400	12,670,200	[3]2,862,900	3,163,800
Total	13,124,900	13,914,700	3,336,700	4,018,600
Grand total	13,126,377	13,948,614	3,337,886	4,048,408

[1] Includes rough construction, dressed, and sawed stones.

[2] Includes stone used in railroad ballast, coal dust, cement, lime, fill, roofing chips, feed supplement, and soil conditioner.

[3] Includes stone used in coal dust, cement, lime, trestle fill, landscaping, roofing granules, feed supplement, and soil conditioner.

Sulfur.—The production equipment at the Sulphurdale plant of American Sulphur & Refining Co. was sold in 1959. According to reports, no sulfur-bearing material was mined during the year.

Sulfuric Acid.—As a result of the copper strike at the Garfield smelter of Kennecott Copper Corp., sulfur-bearing feed gas used by the acid plant of Garfield Chemical and Manufacturing Corp. was interrupted for about 4½ months, and acid production was substantially below 1958. Texas-Zinc Minerals Corp. operated its contact sulfuric acid plant at Mexican Hat to provide acid for its uranium mill. The 20-ton-per-day acid plant of United States Steel Corp. at Provo, built in 1957, also was active in 1959; coke oven gas was the source of sulfur.

Talc.—Crude talc mined in California and Montana was ground in the Ogden mill of Tri-State Minerals Co. The principal market for the product was the paint industry, although a small quantity was sold to ceramic manufacturers.

Vermiculite.—Exfoliated vermiculite produced at Salt Lake City plant of Vermiculite-Intermountain, Inc., was used for insulation, fireproofing, plaster, and acoustic mediums. Mines in Montana supplied the crude vermiculite to the Utah mill.

REVIEW BY COUNTIES

Beaver.—Contractors for the State road commission and construction and maintenance crews of the commission were responsible for the production of 99,500 tons of structural and paving gravel, valued at $67,000, which accounted for half of the total value of all minerals produced in Beaver County. Acme Lite-Wate Products, Inc., continued to mine perlite for use at its expanding plant at Salt Lake City.

Gold, silver, copper, lead, and zinc with a combined value of $13,000 was produced from one mine. A small quantity of iron ore was shipped from one mine for use as a heavy concrete aggregate in Idaho.

Uranium ore was produced by Mystery Sniffer Mines, Inc., and Gaus Brothers and processed at the Vitro Chemical Co. plant at Salt Lake City.

Box Elder.—The total value of mineral production dropped from $21.1 million in 1958, to $2.4 million in 1959, principally because of the decline in output of sand and gravel and stone. This decrease resulted from the completion of the fill for the railroad causeway across the Great Salt Lake.

Production of solar-evaporated salt by the Lake Crystal Salt Co. near Saline rose to 11,800 tons, 9 percent greater than in 1958.

Carbon.—Production of coal from 29 underground mines, which accounted for 76 percent of all coal produced in the State, was 13 percent below that of 1958. Much of the coal produced in Carbon County was used for manufacturing coke for steel plants, and a number of the mines were idle during the steel strike. Major producers were Kaiser Steel Corp., operating the Sunnyside Nos. 1, 2, and 3 mines; Independent Coal & Coke Co., Castle Gate Nos. 2 and 4, Clear Creek No. 3, Kenilworth, and O'Connor No. 1 mines; United States Steel Corp., Columbia-Geneva mines; Carbon Fuel Co., Carbon Fuel mine; and Lion Coal Corp., Wattis No. 1 mine. Independent Coal and Coke Co. continued its modernization program, designed to develop new coal resources and reduce operating costs. United States Fuel Co. was developing a new process to produce metallurgical-grade

TABLE 16.—Value of mineral production, by counties

County	1958	1959 [1]	Minerals produced in 1959 in order of value
Beaver	$57,075	$121,648	Sand and gravel, uranium ore, perlite, zinc, copper, iron ore, silver, gem stones, lead, gold.
Box Elder	21,055,170	2,352,060	Stone, sand and gravel, salt, gem stones.
Cache	436,000	429,300	Sand and gravel, stone.
Carbon	25,840,203	23,698,854	Coal, natural gas, sand and gravel, carbon dioxide, gem stones, barite.
Daggett	[2] 485,700	505,500	Sand and gravel, natural gas, natural gasoline, stone.
Davis	365,938	268,900	Sand and gravel.
Duchesne	[2] 31,780	80,420	Petroleum, sand and gravel, natural gas.
Emery [3]	7,051,398	7,113,583	Coal, uranium ore, sand and gravel, natural gas, gem stones.
Garfield [3]	132,041	183,580	Uranium ore, gem stones, clays.
Grand [3]	1,329,511	1,236,500	Uranium ore, natural gas, manganese ore and concentrate, sand and gravel, petroleum, gem stones.
Iron	25,363,180	20,404,143	Iron ore, sand and gravel, coal, stone, uranium ore, gem stones.
Juab	[4] 1,990,727	1,645,382	Clays, uranium ore, sand and gravel, gem stones, lead, stone, manganese ore and concentrate, iron ore, zinc, barite, copper, silver, fluorspar, gold.
Kane	245,413	6,583	Coal, gem stones.
Millard	78,079	113,192	Pumice, sand and gravel, gem stones.
Morgan	6,966,399	7,522,963	Cement, stone, sand and gravel, clays.
Piute	([5])	172,468	Uranium ore, silver, copper, gold, lead, zinc, gem stones.
Rich	([5])	1,100,277	Phosphate rock, sand and gravel, manganese ore and concentrate.
Salt Lake	144,334,874	127,593,024	Copper, molybdenum, gold, lead, zinc, silver, sand and gravel, salt, cement, stone, lime, pyrites, gem stones.
San Juan [3]	[2] 99,332,062	139,385,905	Petroleum, uranium ore, natural gas, LP-gases, natural gasoline, copper, sand and gravel, silver, zinc, gold, lead, gem stones.
Sanpete	322,034	169,683	Sand and gravel, natural gas, salt, stone.
Sevier	1,205,668	1,366,001	Gypsum, coal, clays, sand and gravel, salt, silver, gem stones, uranium ore, gold.
Summit	4,000,058	3,585,336	Zinc, lead, silver, coal, gold, clays, sand and gravel, stone, copper.
Tooele	4,304,859	4,045,749	Lime, potassium salts, salt, stone, clays, sand and gravel, lead, zinc, gold, silver, copper, gem stones.
Uintah	[2] 16,456,817	23,799,371	Petroleum, gilsonite, natural gas, sand and gravel.
Utah	1,775,975	1,530,751	Stone, sand and gravel, clays, lime, lead, silver, gold, copper, zinc, gem stones.
Wasatch	2,257,910	1,887,102	Zinc, lead, gold, silver, copper, sand and gravel.
Washington	138,230	62,846	Sand and gravel, copper, petroleum, stone, gem stones, zinc.
Wayne	[3] 19,970	28,924	Sand and gravel, uranium ore, gem stones.
Weber	[4] 177,707	569,162	Sand and gravel, clays, stone.
Undistributed [6]	[2] 2,540,473	3,067,748	
Total [7]	[2] 367,232,000	373,017,000	

[1] Value of natural gas and petroleum are preliminary.
[2] Revised figure.
[3] Excludes vanadium.
[4] Excludes value of manganese ore sold and blended at Government low-grade stockpiles for future beneficiation.
[5] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[6] Includes all vanadium, some sand and gravel, and gem stones, and values indicated by footnote 5.
[7] Total adjusted to eliminate duplication in value of raw materials used in manufacturing cement and lime.

coke from Utah bituminous coal. The company was producing 550 pounds of coke a day in a small pilot plant and was considering construction of a larger pilot plant.

Production of carbon dioxide from the Farnham Dome field declined 23 percent from 1958. The gas was transported through a pipeline to Wellington for conversion into dry ice by Carbon Dioxide & Chemical Co. Natural gas from 13 wells in the Clear Creek field in Carbon and Emery Counties was marketed through pipelines to consumers in the Salt Lake City area. One gasfield, Stone Cabin, was discovered. The discovery well completed in April flowed 5 million cubic feet of gas a day from the Wasatch formation at a depth of 5,183 to 5,316 feet.

Daggett.—The Federal Bureau of Public Roads, Bureau of Reclamation, and the Utah State Road Commission produced 354,000 tons of sand and gravel.

Production of natural gas from 10 wells in the Clay Basin field increased 23 percent over 1958. Mountain Fuel Supply Co. processed the gas in its natural-gasoline plant. Residual gas was marketed through company pipelines to consumers in the Salt Lake City area, and the natural gasoline recovered was used by Salt Lake City refineries as blending stock.

Duchesne.—Petroleum production from the Duchesne field and two new fields increased tenfold over 1958. A discovery well at the Chokecherry field, completed in October, pumped 54 barrels of oil a day from the Green River formation at a depth of 4,296 feet. At the Starr Flat field, also completed in October, initial production was 306 barrels of oil a day on pump from the Wasatch formation at a depth of 11,835 to 11,895 feet. One of two development wells completed was successful.

Emery.—Coal production from 11 underground mines (accounting for 22 percent of State production of coal) was 22 percent below that of 1958. Major producers were United States Steel Corp. from that portion of the Geneva mine lying in Emery County; United States Fuel Co., operating the King mine; Book Cliffs Coal Co., Book Cliffs mine; and Cooperative Security Co., Desert mine.

Natural gas produced from three wells in the Flat Canyon field was 44 percent below that of 1958.

Uranium ore, produced at 47 locations, increased slightly over 1958. Principal producers included Four Corners Uranium Corp. at the Incline group and Out West mines; Union Carbide Nuclear Co. at the AEC Nos. 6, 8, and 11; North Mesa, North Mesa No. 9, and Red No. 2 mines; Vitro Chemical Co. at the Red No. 2 and Jack Rabbit mines; and Conrad Uranium, Inc., at the Conrad group mines. The ore was processed at mills at Moab, Monticello, and Salt Lake City, and at the Union Carbide Nuclear Co. upgrading plant at Green River. The latter plant operated the entire year and shipped upgraded material to the mill at Rifle, Colo.

Garfield.—Uranium ore produced at 41 operations was 11 percent greater than in 1958. Shipments from individual mines were small, ranging from 2 to 120 tons. The average grade of the ore shipped, however, was 0.78 percent (15.6 pounds per ton) uranium oxide. The grade of individual shipments ranged from 0.11 percent to more than 4 percent uranium oxide. Most of the ore shipped also contained appreciable quantities of vanadium, some in excess of 4 percent vanadium oxide. The bulk of the shipments went to mills in southwestern Colorado, where the vanadium was recovered. Other ores containing only minor amounts of vanadium were processed at mills at Monticello and Salt Lake City.

American Mud & Chemical Corp. produced 2,000 tons of bentonite at its mine near Cannonville. The county was the second largest source of gem or ornamental stones in the State in 1959. The material collected was valued at $33,000 and consisted primarily of petrified wood and agate.

Three exploratory wells were completed during the year, but none were successful.

Grand.—Uranium ore produced at 51 operations increased 17 percent over that of 1958. Major producers were Union Carbide Nuclear Co., operating 16 mines; Thornburg Mining Co., Corral Nos. 1 and 2 mines; and Climax Uranium Co., Cactus Rat and Cactus Rat No. 4, Cane Creek SC Sec., and Mineral Polar No. 22 mines. Greatest production was from the Polar Mesa, Yellow Cat, and Cane Canyon districts. The ore was shipped to mills in Utah and Colorado and to the upgrading plant at Green River for processing. Uranium Reduction Co. operated its 1,500-ton-a-day processing plant throughout the year. An amended concentrate purchase agreement with AEC was approved August 3 that extended the expiration date of the original contract from March 31, 1962 to December 31, 1966. The amendment also provided for converting one of the acid circuits to a carbonate circuit capable of treating high-lime ores of the district and provided an assured market for numerous independent producers. The company awarded a contract for construction of a $2.5 million alkaline-leach circuit at the plant which it expected to complete early in 1960.

Five of the nine mining operations from which manganese ore and concentrate were shipped during 1959, under the carlot government purchase program, were in Grand County. A total of 915 short wet tons of material value at $76,000 and averaging 41.8 percent manganese was shipped from these five operations. Loyd W. Smith and Gene F. Tom were the principal producers.

Petroleum production at four fields was 18 percent less than in 1958. Major production was from the Big Flat field; minor production came from the Seiber Nose, Cane Creek, and Cisco fields. Eight exploratory wells were completed; one was a successful gas well. Natural-gas production from the Bar X and Westwater fields declined 14 percent, compared with 1958. A new producing horizon was discovered at the Westwater field with completion of a multipay producer. The well flowed 7 million cubic feet a day from the Entrada formation at a depth of 5,112 to 5,218 feet, and 9 million cubic feet a day from the Morrison formation at a depth of 4,602 to 4,822 feet; total depth was 5,289 feet. Four other development wells were successful.

Iron.—Except for small quantities from Beaver and Juab Counties, the iron ore from Utah in 1959 came from nine mines in Iron County west of Cedar City. Columbia Iron Mining Co. (United States Steel Corp.) shipped ore from the Desert Mound and Iron Mountain mines to the corporation's Utah steel mills and was the State's leading iron-ore producer. The Colorado Fuel and Iron Corp. produced ore from its Blowout, Comstock, and Duncan mines for its Colorado steel plant. Utah Construction & Mining Co. mined ore from The Colorado Fuel and Iron Corp., Iron County mines, under contract and shipped ore from its own Excelsior mine to buyers in Utah and California. Helene E. Beatty shipped ore (float) from three groups of claims on a royalty basis to eastern and western markets. Iron-ore shipments from these operations accounted for 98 percent of the value of mineral production in Iron County.

Coal production by Koal Kreek Coal Co., Tucker Coal Co., and Webster Coal Co. was 22 percent greater than in 1958.

Teton Mining Co. shipped a small quantity of uranium ore from the Desert View mine to Salt Lake City for treatment.

Juab.—Seventy-five percent of the total value of mineral output was from nonmetals. Construction and maintenance crews of the Utah State Road Commission and contractors for the commission produced 237,400 tons of sand and gravel. Filtrol Corp., operated the Dragon kaolin mine and shipped the clay to its Salt Lake City processing plant.

Termination of the U.S. Government metallurgical fluorspar purchase program at the end of 1958 adversely affected mining operations in Juab County in 1959. Output dropped from 16,000 tons in 1958 to less than 1,000 tons. The Dugway Mountain region of the county was the principal source of ornamental stones, and the county led the State in terms of the value of these stones. Crushed sandstone continued to be quarried by General Refractories Co., for use at its Lehi refractories plant. A small quantity of barite was mined by D. J. Garrick and shipped to Salt Lake City for grinding.

Uranium ore produced at the Yellow Chief mine by Topaz Uranium Co., was shipped to Vitro Chemical Co. at Salt Lake City for treatment.

The gold, silver, copper, lead, and zinc output came from three mines, Centennial-Beck-Victoria operated under lease by Brennan Hannifin, Godiva (mine dump), operated under lease by Ryan Bros., and Privateer operated by Privateer Mining Co. Manganese ore and concentrate were shipped to the U.S. Government by Fred Staats from one mine and by W. F. Morgan from two mines under the carlot purchase program. Lynn Mining Co. shipped brown iron ore from the Iron Blossom mine for use in manufacturing dead-burned dolomite.

Kane.—Coal production from the Smirl-Alton mine accounted for virtually the entire value of mineral production in the county. Tonnage produced increased slightly, but value of output declined. A small quantity of gem stones was produced.

Millard.—This county was the only source of pumice (scoria) in Utah, and output was nearly the same as in 1958. Christensen Construction Co. worked its Red Dome claims near Fillmore and was the leading producer. Central Utah Block Co., of Flowell, mined scoria for use in concrete aggregate and manufacturing building blocks. The State road commission used the bulk of the 15,800 tons of structural and paving gravel produced. The county was the third leading producer of gem and ornamental stones; the material was valued at $12,275.

Morgan.—The entire $7.5 million value of mineral production in Morgan County came from the sale of construction materials. The production of cement at Devil's Slide by Ideal Cement Co. was the most important nonmetals activity. As an outgrowth of the cement operation, a substantial quantity of crushed limestone was quarried as a feed to the cement mill. Two highway contractors quarried and used 314,500 tons of paving gravel for road construction. Interstate

Brick Co. mined miscellaneous clay from its Henefer pit and shipped it to its Salt Lake City brick plant.

Piute.—Vanadium Corp. of America produced uranium ore at the Buddy, Farmer John, Freedom, and Prospector mines. The entire output was shipped to Vitro Chemical Co. at Salt Lake City for treatment and accounted for all the value of mineral produced in the county, except for small amounts from gold, silver, copper, lead, zinc, and gem stones.

Rich.—Mining activity at the Bradley phosphate-rock mine of San Francisco Chemical Co. expanded during the year and resulted in a 29-percent increase in ore shipments to the company's Leefe (Wyo.) processing plant. A contractor produced paving sand and gravel for the Utah State Road Commission. Manganese ore and concentrate were produced by Minerals of Utah and shipped under the Government carlot purchase program.

Salt Lake.—One-third of the State's value of mineral production came from Salt Lake County in 1959. This output was valued at $127.6 million and was 12 percent below the 1958 figure of $144.3 million, primarily as a result of the drop in copper production caused by a strike at the Utah Copper mine. Value of copper output ($88.4 million) was 11 percent below that of 1958 ($99 million). Other metals with significant decreases in output included gold ($2.3 million), molybdenum ($1.2 million), silver ($0.8 million), and zinc ($1 million). The Utah Copper and the U.S. and Lark mines were the first- and second-ranking gold, silver, and copper producers in Utah. The U.S. and Lark also was the leading lead and zinc producer in the State. International Smelting and Refining Co. processed material from the Murray smelter-slag dump in its zinc-fuming plant.

The mining, milling, smelting, and refining operations at the Utah Copper Division, Kennecott Copper Corp., were idled from mid-August through December by a strike. According to the company's annual report, 1959 production of ore decreased 18 percent, and total copper output from all sources dropped 24 percent below the 1958 figures. The decline would have been greater had not a record output been established for the first 7 months of the year. Molybdenum was recovered as a byproduct of copper flotation, and gold and silver were recovered from the sludge from the electrolytic refining of copper anodes. Operation of the Garfield smelter (purchased by Kennecott from the American Smelting and Refining Co. in 1958) was assumed January 1, 1959, giving the company an integrated mine-to-market operation for copper.

Operations by the United States Smelting Refining and Mining Co. at the U.S. and Lark mine and the Midvale mill, where ore from this mine was concentrated, were not seriously affected by the strike, except that substantial quantities of concentrate had to be stockpiled at the mill. The company's lead concentrate and custom-smelting ores and concentrates were treated at the Tooele plant of the International Smelting and Refining Co. until August 19, when the plant was closed by a strike that lasted throughout the year. On the same day, the plants of The Anaconda Co., which processed the Midvale mill zinc concentrate, were struck, and shipments were not resumed until late in December. Custom ores purchased by International were treated on a toll basis in the Midvale mill. Machinery, equipment, and supplies no longer needed as a result of the discontinuance of the Midvale lead smelter operations in 1958 were sold at auction in June. Demolition of the smelter buildings by a contractor was begun in August, but not completed by the close of the year.

Although the value of nonmetals produced in 1959 was only $5.2 million, the role this segment of the mineral industry played in the economy of the community was important. Portland cement was produced by Portland Cement Co. of Utah. The demand for various types of sand and gravel for commercial consumers, as well as for road construction, was supplied from 17 sand and gravel operations. Lime used in processing copper ores was produced by Kennecott Copper Corp. Great Salt Lake was the source of raw material for the solar-evaporation-plant complex of Morton Salt Co. near Salt Lake City. The bulk of the salt produced in 1959 went to out-of-State consumers. The county also was the source of crushed limestone used in manufacturing cement. Pyrite was recovered from mill tailings and used to supplement sulfur in smelter gas for manufacturing sulfuric acid. Plants to produce building brick and other heavy clay products were operated by Utah Fire Clay Co. and Interstate Brick Co., and a perlite grinding plant was operated by Acme Lite-Wate Products, Inc. Crude barite from Carbon and Juab Counties was ground by the Yuba Milling Division of Metals Disintegrating Co., Inc. Vermiculite Intermountain, Inc., exfoliated vermiculite received from Montana mines.

Refineries in the Salt Lake City area—Phillips Petroleum Co., Salt Lake Refining Co., Utah Oil Refining Co., and Western States Refining Co.—operated throughout the year. Throughput was 30.3 million barrels, a 2.6-percent increase over 1958. Vitro Chemical Co. operated its 660-ton-a-day uranium plant at Salt Lake City. Production in 1959 exceeded design capacity and 1.5 million pounds of uranium oxide was recovered. A higher grade product and lower costs were achieved by converting the solvent extraction circuit to an amine solvent.

San Juan.—San Juan County continued to lead the State in production of uranium ore, petroleum, natural gas, and natural-gas liquids. Uranium ore valued at $34.5 million, was produced at 167 operations. The output declined slightly from 1958, when shipments were recorded from 196 operations. Major producers were Hidden Splendor Mining Co., Far West mine; Jen, Inc., Pasco Jen Jackie; Standard Uranium Co., Big Buck group; Lisbon Uranium Corp., Dixie Fraction, Ike, Judy Lee, Judy Lee No. 1, and Nixon; Texas-Zinc Minerals Corp., Happy Jack; Utex Exploration Co., Mi Vida; Homestake Mining Co., North Alice; La Sal Mining & Development Co., Dissipation and Richardson; and Hecla Mining Co., Hot Rock and Radon. The Texas-Zinc Minerals Corp. operated its 1,000-ton-a-day uranium mill at Mexican Hat throughout the year. A water shortage during the summer months threatened to curtail operations, but conservation measures permitted continued operations. The Government-owned 350-ton-a-day plant at Monticello, operated by National Lead Co., was closed at the end of the year as shipments of ore from producers steadily declined and requirements for uranium concentrates by AEC could be supplied elsewhere. The mill was maintained on a standby basis.

Petroleum production jumped from 21.1 million barrels in 1958 to 35.2 million barrels, with a value of $100.7 million in 1959, an increase of 70 percent. Development in the Greater Aneth area was mostly in the Aneth, White Mesa, Bluff, Ratherford, McElmo Creek, Cahone, Mesa, and Ismay fields. Of 178 development wells completed in the county, 144 producers were in these 8 fields. The most significant discovery in the Four Corners area, if not the entire Rocky Mountain area, was the No. 1 Northwest Lisbon well drilled by Pure Oil Co. at the northwest end of the Lisbon Valley anticline. The well had not been completed at yearend, but tests indicated the well would be a major producer of both oil and gas. The oil was from Devonian and the gas from Mississippian formations. The well flowed as much as 587 barrels of oil a day through a small choke, and gasflows were as high as 17.5 million cubic feet a day. A series of drill-stem tests indicated a total of 1,000 feet of oil and gas producing zones in Mississippian, Devonian, and Cambrian formations. There were 4 oil discoveries and one gas discovery, all in the Greater Aneth area, from 43 exploratory wells completed.

Secondary recovery in the Aneth area was given considerable study during the year. An engineering report prepared for the Utah Oil and Gas Conservation Commission indicated a primary recovery of slightly more than 14 percent. Waterflooding would increase recovery to slightly more than 28 percent. Gas injections following waterflooding would increase total recovery to nearly 30 percent. The five major fields in the Greater Aneth area generally are conceded to be one huge reservoir, and the productive area covers 55,000 acres with 380 wells. Complete development on an 80-acre spacing would require 600 wells. Original oil in the pool, as now defined, has been estimated at 833.9 million barrels with ultimate recovery of 247.7 million barrels. The commission approved pilot-flooding operations by Texaco, Inc., in the Aneth field and by Phillips Petroleum Co. in the Ratherford field.

El Paso Natural Gas Co. completed its natural-gas plant in the Aneth field. The plant, with a rated capacity of 150 million cubic feet of natural gas a day, was processing 80 million cubic feet daily and recovering in excess of 300,000 gallons of natural-gas liquids at yearend.

All gold, silver, copper, lead, and zinc produced was recovered as a byproduct of the treatment of uranium ores from several mines operated in the county.

Sanpete.—Salt, sand and gravel, and stone accounted for 69 percent of the total value of Sanpete County mineral production in 1959. Contractors for the Utah State Road Commission, maintenance crews for the Ephraim City Corp., and Cox Bros. produced 121,800 tons of building and paving sand and gravel. Rock salt continued to be produced from the Axtell mine of Royal Crystal Salt Co. Poulson Bros. Salt Co. quarried crushed limestone for sugar refining, and Azome Utah Mining Co. produced a small tonnage of crushed miscellaneous stone for use as concrete and road metal.

Natural-gas production, all from Joe's Valley field, declined 73 percent, compared with 1958, owing to gradual depletion.

Sevier.—Nonmetals accounted for 79 percent of the value of mineral output in Sevier County. The mines and gypsum-product plants of United States Gypsum Co. and Bestwall Gypsum Co. operated at a higher rate, and output was 21 percent greater than in 1958. Macco Corp. continued to produce bentonite at its Bosshardt mine, and the crude material was milled at Aurora mill of Western Clay & Metals Co. The latter company mined fuller's earth from its Aurora deposit and bentonite from the Redmond area and milled the crude material at Aurora. Rock-salt output reported by Poulson Bros. Salt Co. of Redmond was about the same as in 1958. Production of sand and gravel for building and paving uses was more than double the 1958 figure.

Coal production by Southern Utah Fuel Co. declined 6 percent, compared with 1958. La Verkin Mining Co. produced a small quantity of uranium ore at the Heims No. 2 mine. The ore was shipped to an upgrading plant at Green River for processing.

Summit.—The value of gold, silver, copper, lead, and zinc produced, represented $3.4 of the $3.6 million combined value of all minerals produced in the county. United Park City Mines Co. was the principal producer of each of these metals and was the second largest lead and zinc producer in the State in 1959. McFarland & Hullinger, lessees from United Park, shipped fluxing material containing small recoverable quantities of gold, silver, and copper from the Daly dump to the Kennecott Copper Corp. Garfield smelter. George and Ray Wortley, also lessees from United Park, sold lead ore from the Daly West mine to International Smelting and Refining Co., Tooele, for treatment in the United States Smelting Refining and Mining Co. Midvale mill.

A stronger demand for miscellaneous clay for brick and other heavy clay products resulted in a 24-percent increase in output from the Henefer pit of Utah Fire Clay Co.

Coal output in the county, all produced by the Chappel Coal Co., was slightly greater than in 1958.

Tooele.—The Five Mile Pass area of the county was the source of miscellaneous clay, used by Utah Fire Clay Co. and Interstate Brick Co. at their Salt Lake City brick plants. Hydrated lime and quicklime were produced by Utah Lime & Stone Co. at its Grantsville kiln, and Utah Marblehead Lime Co. reported increased output of dead-burned dolomite from its Delle plant. The dolomite was quarried near the plant. Iron ore and coal used in the process were purchased from other areas. Wendover potash refinery of Bonneville, Ltd., reported a 24-percent increase in the production of potash, and a stronger demand for this fertilizer material brought about a 5-percent gain in shipments. Salt production by Leslie Salt Co. (Tooele), Solar Salt Co. (Grantsville), and Utah Salt Co. (Wendover) was nearly double the 1958 total. A shift in highway construction away from Tooele County resulted in a drop in sand and gravel output from 200,500 tons in 1958 to 28,500 tons in 1959. Limestone for manufacturing lime was quarried in the county, and, in addition, United States Smelting Refining and Mining Co. quarried oolitic limesand on Stansbury Island. Harborlite Corp. did not work its Faust pumice deposit in 1959.

International Smelting and Refining Co. reclaimed cold slag from the Tooele lead smelter dump and treated it in its zinc-fuming plant primarily to recover the zinc. It also made a cleanup of the idle Tooele concentrating mill and shipped the material recovered to the United States Smelting Refining and Mining Co. Midvale mill for recovery of the contained metals (mainly lead and zinc). Production of copper, lead, and zinc ores was reported from five other operations in the county.

Uintah.—Petroleum production from five fields increased 31 percent over 1958. Producing fields were Ashley Valley, Red Wash, Roosevelt, Brennan Bottom, and Gusher. From 13 exploratory wells drilled, one producing oil well and 3 gas wells were obtained. The successful oil well developed a new producing horizon in the Red Wash field and pumped 210 barrels of oil a day from the Green River formation at a depth of 5,820 to 5,846 feet. Of 27 development wells drilled in the Red Wash field, 19 were oil wells and 4 were gas wells. Three of the gas discoveries produced 3.4, 3.9, and 5.0 million cubic feet of gas a day, respectively, from the Wasatch formation. Natural-gas production from the Chapita Wells field increased 35 percent, compared with 1958. The Utah Cooperative Refining Co., at Jensen, operated its 1,500-barrel-a-day refinery. Throughput was 194,188 barrels, a decline of 19 percent compared with 1958.

Gilsonite was produced at five mines and increased 20 percent compared with 1958. American Gilsonite Co., the major company and the one that pioneered hydraulic mining of the mineral, tested a new mining method by which jet nozzles were suspended from the surface of the 1,600-foot gilsonite vein on a mobile rig. The shattered gilsonite fell to the bottom of the mine and was transported through a channel to the central sump and pumped to the surface. Experimental work had produced as much as 1,300 tons in an 8-hour shift, compared with 1,000 tons by the underground hydraulic method. The new method required no timbering, and should any of the mined-out area cave, a new hole or shaft could be drilled and the cutting process continued. The company believed the jet mining equipment could be suspended at a depth of more than 1,000 feet without mechanical difficulty. Underground television cameras were suggested as a means of observing the mining process and flow of water and ore along the bottom of the drift to the central sump. In 1959 most of the output was pumped through a 72-mile pipeline to the American Gilsonite Co. processing plant near Fruita, Colo., for the production of gasoline, diesel fuel, and metallurgical coke. Other producers marketed their production in the Salt Lake City area, where a substantial quantity was used as a base for paint.

Utah.—Seven clay mines produced 70,600 tons of fire and miscellaneous clays. The fire clay was produced at the No. 24 pit, United Brick Co.; Clinton mine, Utah Fire Clay Co.; Wadley pit, R. D. Wadley Clay Co.; and the Fawn mine, Western Fire Clay Co. Miscellaneous clay was extracted from North and Northeast claims by Loyd R. Stubbs and from the Powell pit by Interstate Brick Co. The Lake Mountain mine, operated by Murray Refractories Co. in 1958, was idle during 1959, as was the South pit of Loyd R. Stubbs. Lakeside Lime & Stone Co., Lehi, operated its limestone quarry and limekiln, but output was slightly less than in 1958. Sand and gravel production accounted for one-third of the total value of all minerals produced in the county in 1959. Utah county ranked third in the State in output of sand and gravel. Strikes in the steel and copper industries adversely affected the quantity of limestone quarried; output dropped 29 percent below 1958.

The county's output of gold, silver, copper, lead, and zinc came from operations at four mines. G. Wm. Wortley, lessee of the Eureka Standard dump, was the major producer of gold, silver, and copper. Material from the dump was treated by the Garfield smelter mainly for its fluxing properties. L. J. & S. A. Ryan, lessees of the Yankee Consolidated dump, shipped material to the International Smelting and Refining Co. Tooele lead smelter. Crude lead ore was produced and shipped directly to the smelter from the Iron Blossom and Colorado Consolidated mines.

Wasatch.—Except for a small quantity of sand and gravel, the value of mineral production in the county came from the output of gold, silver, copper, lead, and zinc. The major producer was the Mayflower-Galena mine, owned by New Park Mining Co. and operated by the Mayflower Lease (Leo H. Hatch, lease manager, and Wm. N. Larsen and Bert G. Johnson, assistant lease managers). An average of 85 lessees has worked on this lease for 2½ years. The ore produced was treated at the United States Smelting Refining and Mining Co. Midvale mill, where lead and zinc concentrates were recovered and marketed. Part of the United Park City Mines Co. mining operation (described under Summit County) is in Wasatch County. The major part of the production came from Summit County; therefore, for statistical purposes, the mine is counted in Summit County.

Washington.—Emerald L. Cox shipped crude copper ore from the Apex mine to the Hayden (Ariz.) and El Paso (Tex.) smelters of American Smelting and Refining Co.

Petroleum production from the Virgin field increased fourfold, compared with 1958. Two unsuccessful exploratory wells were drilled, and two successful development wells were completed.

Wayne.—A small quantity of uranium ore was produced from three mines and shipped to Vitro Chemical Co. at Salt Lake City and the upgrading plant at Green River for processing.

Weber.—The county ranked second in sand and gravel production, and output was more than double the 1958 total. Building and highway construction accounted for the gain. Miscellaneous clay production from a company-owned pit of the Harrisville Brick Co. plant, Harrisville, also more than doubled.

The Mineral Industry of Vermont

By James R. Kerr[1]

◆

VERMONT'S output of minerals in 1959 increased 9 percent. The only commodity showing a decline was clay. The leading factor in the recovery following the 1958 closing of the copper mine of Appalachian Sulphide, Inc., was the greater demand for dimension marble and granite as producers pursued an active promotional program to increase the market for these products. Output of sand, gravel, and crushed stone for paving material gained in response to accelerated roadbuilding and maintenance programs.

Rutland County, with its valuable slate and marble deposits, again lead in value of mineral output. Washington and Orleans Counties ranked second and third, with granite and asbestos their leading minerals, respectively.

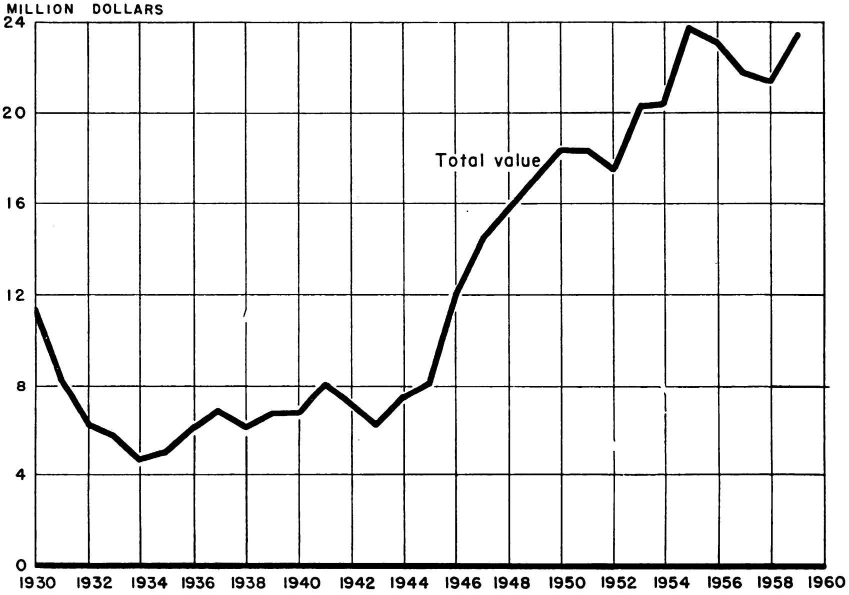

Figure 1.—Total value of mineral production in Vermont, 1930–59.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

TABLE 1.—Mineral production in Vermont[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Copper (recoverable content of ores, etc.)	475	$250		
Gem stones	(2)	1	(2)	$1
Sand and gravel	1,881,990	1,316	2,320,327	1,590
Silver (recoverable content of ores, etc.) troy ounces	5,101	5		
Stone	808,169	15,789	944,298	17,372
Value of items that cannot be disclosed: Asbestos, clays, lime, talc		4,106		4,420
Total Vermont[3]		21,443		23,359

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Weight not recorded.

[3] Total adjusted to eliminate duplicating value of stone.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—Chrysotile asbestos was marketed in 24 grades, determined by length and quality of fiber. Selling prices ranged from approximately $30 to $475 per ton and averaged $95.66 per ton compared with $93.14 per ton in 1958.

Clays.—Production of miscellaneous clay dropped sharply because the manufacture of building brick was reduced significantly.

Gem Stones.—Specimens of jasper, graphite, garnet, and talc were collected at scattered locations throughout the State.

Lime.—Quick and hydrated lime, chiefly for chemical and industrial uses, was produced at virtually the same rate as in 1958.

Mica, Reconstituted.—The Samica Corp. (subsidiary of Minnesota Mining & Manufacturing Co.) at Rutland produced reconstituted mica from specially delaminated mica scrap.

Sand and Gravel.—Production of commercial sand and gravel increased 17 percent, with increased output reported for all use categories. Paving material, most notably paving gravel, was in the greatest demand (26-percent increase), attesting to increased road-building activity in the State. Orleans and Lamoille Counties were the areas of greatest increase in mining activity. The average value of sand and gravel decreased $0.02 to $0.94 per ton. The percentage of commercial output washed, screened, or otherwise prepared increased 2 percent to 63 percent.

Government-and-contractor production, reported from 12 of the State's 14 counties, increased 26 percent. Significant increases were reported from Rutland, Bennington, Addison, Essex, and Lamoille Counties. Production, used almost entirely for paving, was 91 percent gravel and 9 percent sand. Government-and-contractor production was used mostly as bank-run material, only 17 percent being prepared, in contrast to commercial production, most of which was prepared.

Stone.—Value of stone production increased 10 percent owing to a greater demand for dimension marble and dimension granite. An expanded market for cut marble for exterior building was the main factor in the increased value of stone output. In total tonnage, the greatest increase was in crushed granite. Its use for concrete aggregate and road-base material increased 64 percent over 1958. Crushed limestone was produced in large quantities for concrete aggregate and roadstone, but that produced for the whiting industry had by far the greatest market value. Slate production dropped, owing to slackened output of crushed slate for both artificial and natural roofing granules. Production of dimension slate remained at virtually the 1958 rate.

According to preliminary data, 1,633 men were employed by the stone industry in the State, working a total of 3,776,110 man-hours. One fatal and 170 non-fatal injuries marred the industry's safety record, and the accident-frequency rate was relatively high at 45.4 per million man-hours of exposure.

Talc.—The 5-percent rise in talc production marked the second successive year of increased output following a 3-year decline. Talc was ground and consumed chiefly in roofing, rubber, paper, insecticides, paint, and asphalt.

REVIEW BY COUNTIES

More than 1.25 million tons of Government-and-contractor sand and gravel was produced. The Vermont State Highway Department reported production, either by its own construction crews or for use under contract, in every county except Chittenden and Grand Isle. In addition, the cities of Barre and Montpelier in Washington County reported their crews were active in road-maintenance programs during the year. Government-and-contractor operations are not summarized in the individual county reviews but are listed in table 2.

TABLE 2.—Government-and-contractor sand and gravel, by counties, in short tons

County	1958	1959	County	1958	1959
Addison	14,000	88,945	Orange	142,934	61,211
Bennington	60,913	163,971	Orleans	81,476	115,676
Caledonia	39,347	13,880	Rutland	111,054	250,688
Chittenden	10.150		Washington	93,237	95,732
Essex	54,000	122,186	Windham	102,392	86,730
Franklin	37,753	14,700	Windsor	213,480	143,938
Grand Isle	3,500				
Lamoille	31,167	98,845	Total	995,403	1,256,502

Addison.—Vermont Associated Lime Industry, Inc., produced chemical, industrial, and building lime at its New Haven plant. The company also quarried limestone for use as concrete aggregate. Vermont Kaolin Corp. announced partial development of its Electra plant near Monkton during the year. Production was to begin in August 1960.

Bennington.—Building and paving sand and gravel were produced by William E. Dailey, Jr. Building and fill sand and gravel were produced by Burgess Brothers at a stationary plant near Bennington.

TABLE 3.—Value of mineral production in Vermont, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Addison	126,406	168,220	Stone, lime, sand and gravel.
Bennington	(1)	(1)	Sand and gravel.
Caledonia	(1)	(1)	Do.
Chittenden	372,296	394,524	Sand and gravel, stone, lime, clays.
Essex	(1)	(1)	Sand and gravel.
Franklin	(1)	(1)	Stone, sand and gravel.
Grand Isle	1,250	(1)	Stone.
Lamoille	(1)	(1)	Talc, sand and gravel.
Orange	1,090,320	907,515	Stone, sand and gravel.
Orleans	(1)	(1)	Asbestos, sand and gravel.
Rutland	10,533,484	11,203,619	Stone, sand and gravel, clay.
Washington	(1)	(1)	Stone, talc, sand and gravel.
Windham	(1)	491,842	Stone, sand and gravel, talc.
Windsor	171,944	321,141	Do.
Undistributed [2]	9,147,300	9,872,425	
Total	21,443,000	23,359,000	

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes values for counties indicated by footnote 1.

Caledonia.—Paving sand and gravel was produced at a portable plant near St. Johnsbury by Caledonia Sand & Gravel Co., Inc.

Chittenden.—Seven commercial sand-and-gravel operators were active. The leading ones, in order of output, were W. C. Kirby, Burlington; Burnette & Campbell, Williston; Cass-Warner Corp., Essex Junction; and Vermont Paving Co., Burlington. County sand-and-gravel output was used mostly for building and paving. Vermont Associated Lime Industries, Inc., produced limestone for agricultural use and as raw material for making lime. Its lime production was consumed entirely for chemical and industrial uses. Drury Brick Co., Inc., produced miscellaneous clay from an opencut mine at Essex Junction for manufacturing building brick.

Essex.—Sand and gravel was produced by A. Booska for paving.

Franklin.—Swanton Lime Works Co. produced crushed limestone, chiefly for use in making paper but also for concrete aggregate and agricultural purposes. Sand was produced by S. H. Evanson at a stationary plant near Swanton, chiefly for building use. Ray Dubois produced a small quantity of sand at Swanton for sanding roads.

Grand Isle.—Vermont Marble Co. quarried a small amount of dimension marble.

Lamoille.—Crude talc, mined near Johnson by Eastern Magnesia Talc Co., Inc., was ground at the company mill and sold chiefly for rubber, paper, and roofing manufacture. A small tonnage of crude was shipped to a foundry supply in Cleveland, Ohio. Paving sand was produced by V. C. Farr near Morrisville, and Albert Nadeau produced paving sand and gravel at a stationary plant near Johnson.

Orange.—Rough monumental granite was produced by Rock of Ages Corp. at the Pirie quarry near Williamstown. Ralph B. Goodrich, Inc., and Willard Martin produced paving gravel near Bethel and East Corinth, respectively, and Levi Lemieux produced sand and gravel for miscellaneous uses near Williamstown.

Orleans.—Vermont Asbestos Mines, Division of Ruberoid Co., produced and processed asbestos at the Lowell quarry and mill. The asbestos was used in making 24 grades of asbestos fiber, the grade depending on length and quality of the fiber material. H. G. Calkins produced sand and gravel for paving at a stationary plant near Coventry.

Rutland.—Vermont Marble Co. produced dimension marble at four quarries and five mills in the county. Green Mountain Marble Co., Division of Georgia Marble Co., operated three quarries that produced dimension marble. Vermont Marble Co. also produced a small quantity of crushed marble. Seventeen slate quarries were active during the year. Central Commercial Co. and Vermont Structural Slate Co. were the leading producers; the former produced crushed slate for roofing granules and the latter, mainly structural and sanitary slate. Crushed limestone for whiting was produced by White Pigment Corp.; Vermarco Lime Co. crushed limestone, chiefly for concrete aggregate and road-base material but also for stone sand, blast-furnace flux, and other uses. Vermont Marble Co. was the leading sand producer in the county, producing sand for use in processing dimension marble. Sand and gravel, principally for building and paving, was produced by Clark & Haynes and Robert Greer at stationary plants near Poultney and by Joseph Carrara, Rutland. Rutland Fire Clay Co. continued to consume material from its miscellaneous clay stockpile to produce a small tonnage of fire-clay mortar.

Washington.—Rock of Ages Corp. produced dimension granite, chiefly for rough monumental stone, at three quarries during the year. Wells-Lamson Quarry Co. also produced rough monumental granite. As in past years, the granite producing area in the county was near Graniteville and Websterville. In addition to dimension granite, Wells-Lamson Quarry Co. produced significant quantities of crushed granite for use as concrete aggregate and road-base material. The highway department of the State of Vermont crushed a small quantity of granite for its own use for road-base material. Eastern Magnesia Talc Co., Inc., continued to operate its mine near Waterbury and produced crude talc which was ground for use in manufacturing rubber, paper, roofing, paint, and insecticides. Paving sand and gravel was produced by King's Pit, and paving and other sands were produced by Wells-Lamson Quarry Co., Inc.; both companies operated stationary plants near Barre. Richard C. Fiddock produced paving gravel near Berlin.

Windham.—Vermont Talc Co. mined talc near Windham for grinding at its mill at Chester, Windsor County. Output was used chiefly for manufacturing insecticides and roofing. Brattleboro Sand & Gravel Co,. near Brattleboro, and West River Sand & Gravel Co., West Townshend, produced paving sand and gravel.

Windsor.—Vermont Marble Co. quarried a small quantity of dimension marble. Eastern Magnesia Talc Co., Inc., mined crude talc near Hammondsville for grinding at the company mill near Gassets. Output was used in making roofing material. Colonial Sand & Gravel, Inc., produced paving sand and gravel at its stationary plant near Sharon. Vermont Concrete Pipe also produced a small amount of paving gravel during the year.

The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Virginia Division of Mineral Resources.

By Robert W. Metcalf,[1] James L. Calver,[2] and Stanley A. Feitler [1]

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VIRGINIA'S mineral production rose 9 percent to $222 million, second only to the 1957 record of $227 million. New marks in tonnage and value were reached by bituminous coal, clays, sand and gravel, stone, kyanite, and salt, and the highest outputs in recent years were recorded for aplite and cement. Accelerated construction increased demand for ceramic and chemical raw materials, and an overall gain in industrial activity were the chief factors in the greater output.

The construction industry consumed more raw materials and was the major factor in increased output of sand and gravel (18 percent), stone (15 percent), and cement (15 percent). Ceramic raw materials showing large gains were aplite (86 percent), kyanite (30 percent), clays (17 percent), and feldspar (8 percent). Increased production of chemical raw materials included salt (15 percent) and pyrites (11 percent). Production of zinc also was 10 percent higher than in 1958.

In order of decreasing value of output, coal, stone, cement, and sand and gravel were the major mineral industries in the State. Fuels valuation comprised 63 percent of total output; nonmetallics, 34 percent; and metals, 3 percent.

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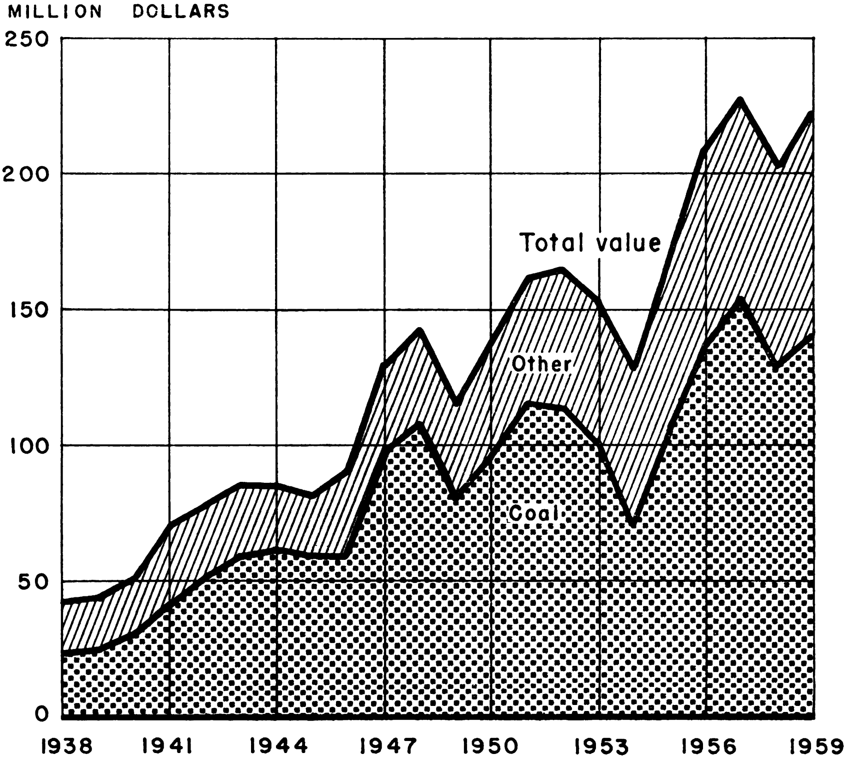

FIGURE 1.—Value of coal and total value of mineral production in Virginia, 1938–59.

Trends and Developments.—A comprehensive and well-documented treatise on current and prospective water supply and use in the State[3] was of particular significance to Virginia and its growing economy. The progress report discusses the vital correlation between adequate water supplies and the health and growth of industry, transportation, recreation, fisheries and wildlife, agriculture, forestry, and municipalities. All phases of the water problem were outlined, and recommendations were made for conserving and using most efficiently this resource so necessary to the general welfare and to the development of industry and agriculture.

Intensified interest in the study of Virginia geology and structural features resulted in the publication of geological studies of drainage problems in the Shenandoah Valley area in western Virginia.[4] Another publication reported on the petrology and occurrence of quartz crystal in southwestern Virginia.[5]

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[3] Virginia State Soil Conservation Committee, Water Resources of Virginia, The Story of Water Conservation in Virginia: Va. State Soil Conservation Committee, Blacksburg, Va., 1959, 112 pp.

[4] Carroll, Dorothy, Sedimentary Studies in the Middle River Drainage Basin of the Shenandoah Valley of Virginia: U.S. Geol. Survey Prof. Paper 314–F, 1959, pp. 125–154; Hack, J. J., and Young, R. S., Intrenched Meanders of the North Fork of the Shenandoah River, Virginia: U.S. Geol. Survey Prof. Paper 354–A, 1959, 10 pp.

[5] Mertie, J. B., Jr., Quartz Crystal Deposits of Southwestern Virginia and Western North Carolina: U.S. Geol. Survey Bull. 1072–D, 1959, pp. 233–298.

Metals and Minerals Division, Metal and Thermit Corp., planned to modify its ilmenite processing plant to permit the preparation of aplite for use in glassmaking and in other applications. Aplite is intended to be the principal product; thus far, ilmenite and rutile have been the principal products. Other minerals occurring in commercial quantities in the ore are mica and sphene.

Industrial expansion in Virginia was particularly evidenced by the growth of the cement and lightweight aggregate industries. Plans were announced for a $6.5 million expansion of the Norfolk, Va., plant of the Lone Star Cement Corp. The company began production of portland cement in the Tidewater area in 1925; the projected 1 million barrel-per-year kiln will raise the plant's annual capacity to 2.3 million barrels.

The growth of the lightweight aggregate industry was highlighted by the beginning of operations in May of the new plant of the Clinchfield Coal Co. at Clinchfield, Russell County, about 12 miles west of Dante[6] and the reported start of construction of a $250,000 lightweight plant by Boston Concrete Products Co., Inc., at Crewe, in Nottoway County.[7] Solite aggregate will be manufactured under arrangement with Solite Corp., formerly Southern Lightweight Aggregate Corp. The two 200-foot kilns of the Clinchfield Coal Co. had a reported 900-ton daily output and were estimated to cost $2.5 million.

Legislation and Government Programs.—The Government continued purchase of mica from miners in Virginia for the strategic minerals stockpile. This material was purchased through the General Services Administration (GSA) Spruce Pine (N.C.) and Franklin (N.H.) Materials Purchase Depots. Metallurgical manganese ore of 35 percent or more manganese content also was purchased under the Defense Production Act carlot purchase program until August, when Government buying was discontinued, owing to the filling of the requirements of the strategic stockpile. Only small shipments were made after that date to complete contracts in effect. Requests by industry for renewal and continuation of the carlot program of manganese ore were not granted.

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[6] Pit and Quarry, vol. 53, No. 1, July 1960, pp. 225–227.
[7] Pit and Quarry, vol. 52, No. 5, November 1959, p. 102.

TABLE 1.—Mineral production in Virginia[1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays	1,152,850	$1,143	1,346,014	$1,397
Coal	26,826,067	130,319	29,768,840	139,224
Gem stones	(2)	3	(2)	4
Lead (recoverable content of ores, etc.)	2,934	687	2,770	637
Lime	471,313	5,533	765,240	8,168
Manganese ore (35 percent or more Mn) gross weight	8,128	647	6,232	499
Manganese ore, ferruginous (10 to 35 percent Mn) gross weight	56	1	(3)	(3)
Mica sheet pounds	147	2	108	1
Natural gas million cubic feet	2,521	681	[4] 1,440	[4] 400
Petroleum (crude) thousand 42-gallon barrels	[5] 4	(3)	[4] 6	(3)
Sand and gravel	7,158,228	10,834	8,451,543	12,369
Silver (recoverable content of ores, etc.) troy ounces	2,023	2	866	1
Stone	15,412,947	27,504	17,786,682	31,447
Zinc (recoverable content of ores, etc.)	18,472	[6] 3,808	20,334	[6] 4,662
Value of items that cannot be disclosed: Aplite, portland cement, masonry cement, feldspar, gypsum, iron ore (pigment material), kyanite, pyrites, salt, soapstone, titanium concentrate (ilmenite and rutile), and values indicated by footnote 3		[5] 25,471		28,848
Total Virginia [7]		[5] 203,277		222,304

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Figure withheld to avoid disclosing individual company confidential data.
[4] Preliminary figure.
[5] Revised figure.
[6] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.
[7] Total adjusted to eliminate duplication in value of clays and stone.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Production of coal rose to 29.8 million short tons, a new record, 1 percent over the previous record year, 1957. The State maintained its sixth ranking position among coal-producing States. Value of production, however, declined 10 percent from 1957, owing to a 4-percent drop in average value per ton. Coal accounted for 63 percent of the value of total mineral production of the State. Low- and high-volatile coals were mined and prepared for domestic and industrial use. A small quantity of semianthracite was produced for domestic heating. Four counties—Buchanan, Dickenson, Wise, and Tazewell—accounted for 90 percent of the total State tonnage. Production of strip and auger coal both increased moderately from 1958. Deep-mined coal, however, increased nearly 3 million tons over 1958, chiefly because of the first full year of operation of the new Moss No. 3 mine of the Clinchfield Coal Co., in Dickenson County. The number of coal mines decreased 9 percent to 1,278, of which 1,203 were underground, 42 were strip, and 33 were auger. The Moss No. 3 mine was the third largest coal mine in the United States. Of total underground production, about one-half was loaded mechanically.

Of the mechanically loaded total, almost 90 percent was loaded by 150 mobile loading machines. Most of the balance was cut and loaded by 17 continuous mining machines, plus a small tonnage by hand-loaded face or room conveyors. Other equipment used at the 1,203 underground mines included 965 cutting machines, 1,316 handheld and postmounted coal drills, 17 mobile drills, and 139 roof and rock drills. Underground haulage was by 545 animals, 753 trolley locomotives, 319 battery locomotives, and 16 other means of locomotion. Intermediate haulage was by 237 cable-reel and 3 battery shuttle cars and 46 portable and 4 stationary rope hoists. Forty-seven mother conveyors averaging 1,989 feet in length provided a coal-gathering haulage service.

Of the total production, 46 percent was cleaned by mechanical methods, mostly by wet washing other than jigs. Twenty-eight cleaning plants were active during the year. Seventeen percent of the tonnage was crushed and 9 percent was treated for dust-allaying and antifreezing purposes using chiefly oil and combinations of calcium chloride and oil.

Equipment employed at stripping operations was 75 power shovels (chiefly under 3-cubic-yard capacity), 9 carryall scrapers, 38 bulldozers, 12 horizontal and 7 vertical overburden drills, and 84 trucks of 11-ton average capacity. Auger equipment included 35 augers, 16 bulldozers, and 24 trucks of average 11-ton capacity.

TABLE 2.—Production and value of bituminous coal, by counties

(Thousand short tons and thousand dollars)

County	1958		1959	
	Quantity	Value[1]	Quantity	Value[1]
Buchanan	9, 570	$43, 196	10, 320	$44, 997
Dickenson	5, 166	24, 926	7, 569	35, 401
Lee	364	2, 062	451	1, 680
Montgomery	12	75	16	46
Russell	2, 672	13, 163	2, 564	13, 081
Scott	2	11	14	62
Tazewell	2, 752	18, 192	2, 500	15, 107
Wise	6, 288	28, 694	6, 335	28, 850
Total	26, 826	130, 319	29, 769	139, 224

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes value for coal not sold but used by producer, such as mine fuel, and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Petroleum and Natural Gas.—Production of petroleum and natural gas in Virginia was small but of local importance. No new oil wells were completed, and no discoveries of oil or gas fields were made. The Rose Hill field in Lee County was the only producer of crude oil. Production of natural gas, chiefly from wells in Dickenson and Buchanan Counties, dropped sharply. Of the eight natural gas wells completed in 1959, five were in Buchanan County, two in Dickenson County, and one in Wise County. According to the American Gas Association, reserves of natural gas as of December 31, 1959, totaled 38,632 million cubic feet, compared with 38,421 million cubic feet at the end of the previous year. All reserves were nonassociated—that is, free gas not in contact with crude oil in the reservoir. Natural-gas output came from the Ravencliff sand, Big Lime, Berea sand, and

Devonian shale formations. The natural gas was marketed through pipelines of the Hope Natural Gas Co. and the Kentucky-West Virginia Gas Co. Three companies in Buchanan County and one firm each in Dickenson and Wise Counties completed natural-gas wells. Descriptions of the oil and gas fields in Virginia, including occurrences, formations in which oil and gas have been located, and a historical summary of drilling was published for both oil and gas[8] and oil and gas possibilities in the southwestern counties of Virginia.[9] A listing was published of all gas wells in Virginia from which well samples had been obtained.[10] Included in the data shown were the operator, the property on which the well was drilled, approximate depth interval of the well (latitude and longitude), total depth reached, number and approximate location of samples, and results of drilling (whether dry or productive). According to the record, 31 successful gas wells were represented in the repository for Buchanan County, 13 for Dickenson County, 1 for Lee County, 4 for Rockingham County, and 4 for Wise County. Well samples from 12 successful oil wells were on file for Lee County.

NONMETALS

Aplite.—Production of aplite was continued by two firms operating near Piney River. Buffalo Mines, Inc., a third company, completed its mine development and mill late in 1959 and began producing crushed and ground aplite for use in glassmaking, roofing granules, and aggregate in brick and block. Tonnage of aplite sold exceeded the 1958 figure by 45 percent. The aplite industry employed 75 persons (excluding officeworkers), who worked 167,533 man-hours. Six non-fatal lost-time injuries were reported to the Federal Bureau of Mines.

Cement.—Combined shipments of masonry and portland cement increased 15 percent in quantity and 13 percent in value compared with 1958. Increased production resulted from greater private and public building, highway, and airport construction during the year. Two companies, operating three plants, produced portland cement with one plant each in Augusta, Botetourt, and Norfolk Counties. Two of the plants also produced masonry cement. Another firm (in Warren County) produced masonry cement only. Captive limestone and shale were used in making dry-process cement at the plants in Augusta and Botetourt Counties. One wet-process plant in Norfolk County used captive calcareous marl and clay as raw material. Local shale was consumed at the Warren County masonry cement plant. General use and moderate-heat portland cement was the chief product, although high-early-strength and other cements were marketed. Virtually all portland and masonry cements were shipped by rail. Over three-quarters was shipped in bulk; the remainder was shipped in paper bags. Small bulk shipments were made by water. Over 40 percent of total shipments of portland cement was made to ready-mix concrete companies, 25 percent to concrete-product manufacturers, 15 percent to highway contractors, and the remainder to other contractors, Federal, State, and local government agencies, and to miscellaneous customers.

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[8] Le Van, D. C., A Review of Oil and Gas in Virginia, Virginia Minerals (published by Virginia Division of Mineral Resources), Vol. 5, No. 2, April 1959, pp. 1–7.

[9] Wilpolt, R. H., and Marden, D. W. Geology and Oil and Gas Possibilities of Upper Mississippian Rocks of Southwestern Virginia, Southern West Virginia, and Eastern Kentucky: U.S. Geol. Surv. Bull. 1072–K, 1959, pp. 587–653.

[10] Le Van, D. C., Catalogue of Oil and Gas Wells in Well Sample Repository on August 1, 1959, Virginia Division of Mineral Resources Information Circular 1, Charlottesville, Virginia, 1959, 11 pp.

Clays.—Stimulated by greater building activity and greater lightweight aggregate output, clay production rose 17 percent in quantity and 22 percent in value. The entire output was miscellaneous clay or shale, chiefly for use in manufacturing building brick and other heavy clay products. Other significant outlets were lightweight aggregate and portland cement manufacture. Fourteen companies in 15 counties mined and processed clay. One idle plant was in standby condition during the year; another discontinued operations at the end of 1959. However, three new plants began operations. The leading clay-mining counties, in order of value of output, were: Botetourt, Chesterfield, Prince William, and Buckingham. According to preliminary data, 362 persons worked 807,324 man-hours in the clay industry. There were 38 nonfatal lost-time injuries, resulting in a frequency rate of 47.1 injuries per million man-hours of worker exposure.

TABLE 3.—Clays sold or used by producers

Year	Short tons	Value	Year	Short tons	Value
1950–54 (average)	810, 846	$818, 700	1957	893, 255	$986, 302
1955	935, 941	873, 348	1958	1, 152, 850	1, 143, 160
1956	1, 000, 019	1, 032, 665	1959	1, 346, 014	1, 396, 433

Feldspar.—Both tonnage and value of ground feldspar produced were greater than in 1958. One firm operating in Bedford County produced potash and mixed potash-soda feldspar, chiefly for manufacturing pottery and enamel and smaller quantities for abrasives, welding-rod coatings, and as brick facing.

Gem Stones.—Gems and mineral specimens were collected by mineral collectors and hobbyists in Amelia County (amazonite), Madison County (unakite and epidote), and Roanoke County (jade onyx). Because the collection of many gem and mineral specimens is not reported, complete coverage was not obtained. However, counties yielding gem stones in recent years and the gems found include: Amelia (albite, cleavelandite, garnet), Louisa (sulfide minerals), Page (epidote, jasper, onyx), Prince Edward (amazonite, amethyst, kyanite), and Rockbridge (unakite).

Gypsum.—Crude gypsum was mined and calcined by United States Gypsum Co. at Plasterco in Washington County at a rate slightly less than in 1958. Calcined gypsum and plasterboard were produced. A calcining plant at Norfolk treated domestic and imported gypsum. Several fertilizer firms in and near Norfolk sold treated gypsum imported from Nova Scotia for use chiefly as an agricultural land dressing.

Kyanite.—Both crude ore mined and sales of refined kyanite increased substantially over 1958 in both tonnage and value. The Kyanite Mining Corp. recovered crude kyanite ore from the Willis

Mountain mine in Buckingham County and beneficiated the crude material in its flotation plant at Dillwyn. The same company operated the Baker Mountain mine and Cullen processing plant to product a flotation concentrate in Prince Edward County. Some of the flotation concentrate was pulverized for special uses at the Pamplin processing plant. A report was published treating the geology, occurrence, properties, uses, and a brief history of significant research on the various applications of kyanite.[11]

Lime.—Increased coverage, particularly of captive lime operations, resulted in a large apparent increase in lime production data in 1959. Chemical and industrial uses comprised 95 percent of the total output. Marketed production of agricultural lime remained at approximately the same level as in 1958, although sales of building lime increased considerably. One company in the Norfolk area used shell for making lime. Of total production, 92 percent was quicklime. Output was concentrated in Giles, Smyth, and Shenandoah Counties, but lime also was produced in Frederick, Isle of Wight, Norfolk, and Tazewell Counties.

TABLE 4.—Lime (quick and hydrated) sold and used by producers, by types

Year	Agricultural		Building		Chemical and other industries		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950–54 (average)	19,046	$226,928	10,146	$118,367	420,089	$4,138,820	449,281	$4,484,115
1955	26,945	333,464	4,355	52,034	462,993	4,663,199	494,293	5,048,697
1956	25,125	322,644	3,572	41,914	483,649	5,561,357	512,346	5,925,915
1957	[1] 17,897	354,287	[1] 4,190	51,995	[1] 35,250	5,622,860	510,216	6,029,142
1958	(2)	(2)	(2)	(2)	438,449	5,119,929	471,313	5,532,833
1959	29,519	351,955	5,345	73,628	730,376	7,742,829	765,240	8,168,412

[1] Excludes production of quicklime to avoid disclosing individual company confidential data; included in total.

[2] Figure withheld to avoid disclosing individual company confidential data; included in total.

Mica.—A small quantity of hand-cobbed and full-trim mica was sold through the GSA Spruce Pine (N.C.) and Franklin (N.H.) Purchase Depots. The mica was mined in Amelia and Henry Counties. Domestic and foreign scrap mica was wet ground by the Richmond Mica Corp., Newport News, for paint, rubber, wallpaper, plastics, and other uses.

Nitrogen Compounds.—Allied Chemical Corp., Nitrogen Division, manufactured nitrogen compounds at Hopewell (Prince George County), chiefly for use as fertilizer or fertilizer components. Products marketed included ammonia, urea solution, ammonium sulfate, synthetic sodium nitrate, and other nitrogen compounds.

Perlite.—Perlite mined in New Mexico and Colorado was expanded at Hopewell, Prince George County, for use in accoustical plaster and ultralightweight aggregate.

Pyrites.—Production of pyrites from the Gossan mine in Carroll County was 11 percent higher than in 1958. General Chemical Division, Allied Chemical Corp., used the output to manufacture sulfuric acid at Pulaski.

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[11] Forkner, H. R., and Whittemore, J. W., Properties and Uses of Virginia Kyanite: Virginia Polytechnic Inst. Eng. Exp. Sta. Ser. 136, Blacksburg, Va., 1959, 12 pp.

Roofing Granules.—The Blue Ridge Slate Corp. crushed and sized slate to produce roofing granules at a Buckingham County plant. In Nelson County, the Riverton Lime & Stone Co., Division, Chadbourn Gotham, Inc., and Buffalo Mines Co., Inc., used aplite as raw material for roofing-granule manufacture.

Salt.—Brine was recovered by Olin-Mathieson Chemical Corp. from underground saltbeds. In response to higher demands for chlorine and soda ash, for which brine is a prime raw material, output rose 15 percent over 1958.

Sand and Gravel.—Output of sand and gravel rose to nearly 8.5 million short tons valued at more than $12 million. A large increase was noted in sand and gravel used in building operations, although paving sand and gravel was marketed at an active rate. Sand and gravel consumed for building and paving uses comprised 52 percent and 37 percent, respectively, of total production. Other types or uses of sand and gravel produced were glass, molding, grinding, engine, filter, railroad ballast, fill, and miscellaneous (including sand for ice control and other purposes). Sand comprised 49 percent of the total output and gravel 51 percent. The average value per ton declined slightly. Production of sand and gravel was reported from 32 counties, compared with 34 in 1958. Commercial operators accounted for 96 percent of the total production; only 4 percent was reported by all State, Federal, and local government agencies. There were 43 commercial operators in 1959 producing sand and/or gravel at 47 pits. Counties leading in production of sand and gravel, in order of size of production, were: Henrico, Fairfax, Chesterfield, and Prince George. Employment in the sand and gravel industry was 666 persons (including 68 officeworkers) who worked 1,493,146 man hours.

TABLE 5.—Sand and gravel sold or used by producers, by classes of operations and uses

Uses	1958		1959	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	1,424,811	$1,928,977	2,060,716	$2,643,117
Paving	1,077,708	1,145,371	1,064,636	1,218,769
Engine	35,516	46,482	(1)	(1)
Filtration	29,247	44,467	18,781	27,749
Fill	501,269	610,973	543,541	510,789
Other [2]	267,163	670,765	363,568	818,722
Total	3,335,714	4,447,035	4,051,242	5,219,146
Gravel:				
Building	1,455,729	2,767,734	2,326,390	4,392,856
Paving	2,138,450	3,446,796	1,727,505	2,423,395
Other [3]	---	---	42,150	22,660
Total	3,594,179	6,214,530	4,096,045	6,838,911
Total sand and gravel	6,929,893	10,661,565	8,147,287	12,058,057
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand: Paving	139,596	75,589	90,079	42,105
Gravel:				
Building	2,635	922	---	---
Paving	86,104	96,397	214,177	268,847
Total	88,739	97,319	214,177	268,847
Total sand and gravel	228,335	172,908	304,256	310,952
Grand total	7,158,228	10,834,473	8,451,543	12,369,009

[1] Figure withheld to avoid disclosing individual company confidential data.
[2] Includes glass sand, molding sand, grinding and polishing sand, railroad ballast (1959), ground sand and engine sand (1959).
[3] Includes fill.

Soapstone.—Although the output of soapstone for grinding was 15 percent less, sales of ground material were slightly greater than in 1958. Soapstone was mined and crushed or ground for use in roofing, rubber, foundry facings, and insecticides by one firm each in Franklin and Nelson Counties. Soapstone sawed for use as dimension stone is included with miscellaneous stone in the stone section of this chapter.

Stone.—Accelerated building and highway construction stimulated the production of stone, which rose 15 percent over 1958 to 17.8 million tons. Stone continued to rank second in both tonnage and value among Virginia minerals. Stone consumed in concrete and highway construction comprised 63 percent of the total stone produced; the manufacturing of cement, 12 percent; and lime manufacturing, 8 percent. Types of stone produced were limestone, basalt, granite, marble, sandstone, miscellaneous stone, calcareous marl, and slate. Oyster and other shell also were prepared for use as agstone and in lime manufacture burning. Limestone comprised 67 percent of the total stone quarried; granite and basalt combined totaled 28 percent. Output consisted chiefly of crushed and broken stone, although dimension sandstone and miscellaneous stone were produced. Stone-producing counties, ranked in order of decreasing output, were: Botetourt, Loudoun, Rockingham, Giles, and Frederick. Some 100 commercial producers in 44 counties and 8 State or municipal agencies in 12 counties produced stone. In addition, four companies produced and marketed shell. Commercial stone producers were distributed as follows: Limestone, 50 companies (57 quarries); granite, 15 companies (18 quarries); basalt, 9 companies (9 quarries); sandstone, 6 companies (6 quarries); marble, 1 company (1 quarry); miscellaneous stone, 2 companies (2 quarries); calcareous marl, 3 companies (3 quarries); and slate, 4 companies (4 quarries). The stone industry in the State employed 3,072 persons (excluding officeworkers) working 7,287,091 man-hours, according to preliminary data. Work-injury experience included 2 fatal and 194 nonfatal lost-time injuries, resulting in a frequency rate of 26.9 injuries per million man-hours of exposure.

TABLE 6.—Stone sold or used by producers, by kinds and uses

Kind and use	1958		1959	
	Short tons	Value	Short tons	Value
Dimension stone:				
Sandstone, all uses	437	$5,215	(1)	(1)
Crushed and broken stone:				
Granite: Concrete and roadstone [2]	2,815,440	4,298,385	2,779,833	$4,273,567
Basalt: Concrete and roadstone [2]	1,149,643	1,900,508	2,231,859	3,761,551
Limestone:				
Riprap	(3)	(3)	5,389	7,398
Fluxing stone	517,861	866,313	621,255	1,051,566
Concrete and roadstone	5,446,882	7,703,025	6,065,427	8,453,678
Railroad ballast	[3] 258,216	[3] 328,233	217,598	273,229
Agricultural	648,735	1,309,775	818,035	1,580,293
Miscellaneous	3,909,878	6,155,923	4,277,843	6,728,281
Sandstone: All uses	238,951	510,777	314,585	572,258
Shell: Miscellaneous uses	19,627	139,421	20,386	(1)
Slate: Dimension and crushed and broken	(1)	(1)	51,877	1,069,591
Undistributed [4]	407,279	4,286,297	382,595	3,675,640
Total	15,412,949	27,503,872	17,786,682	31,447,052

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[2] Includes riprap and railroad ballast.

[3] Riprap included with railroad ballast.

[4] Includes crushed and broken marble, miscellaneous dimension and crushed and broken stone, crushed and broken calcareous marl, and data indicated by footnote 1.

Sulfur.—Hydrogen sulfide was removed from fuel gas and converted to elemental sulfur at the Yorktown refinery of American Oil Co. Production was slightly higher than in 1958.

METALS

Ferroalloys.—Ferromanganese was produced in two blast furnaces at Lynchburg by L. J. Lavino Co. Annual capacity was rated at 128,000 net tons.

Iron and Steel.—Two firms in Virginia operated four electric furnaces with a total capacity of 40,000 tons of ingot and casting steel. Newport News Shipbuilding & Drydock Co. (Newport News) operated three of these with a total capacity of 15,000 tons; Roanoke Electric Steel Corp. (Roanoke) operated a fourth furnace with a capacity of 25,000 tons.

Iron Ore (Pigment Material).—Two companies produced iron oxide pigments. In Pulaski County, one company operated two plants. Crude natural pigments mined near Hiwassee were finished at the Hiwassee plant, where manufactured iron oxide pigments also were produced. At the second plant, near Pulaski, iron oxide pigments were manufactured by chemical treatment of scrap iron. The second company produced a variety of manufactured iron oxide pigments at the Henry plant in Franklin County.

Lead and Zinc Ores.—Output of recoverable lead declined 6 percent in tonnage and 7 percent in value. Production of zinc, however, rose 10 percent, accompanied by a large increase in the average value per pound. Concentrates were produced from zinc-lead ores at Austinville, Wythe County, and from zinc ore at Timberville, Rockingham County. Production from the Ivanhoe mine was resumed in September after a 13-month shutdown; by the yearend, operation of the Austinville concentrating mill was restored nearly to full capacity with ore supplies from the two mines. Zinc concentrate was shipped to Josephtown and Palmerton, Pa., and East Chicago, Ind., for smelting; and lead concentrate to Palmerton, Pa., Federal, Ill., and Houston, Tex. The Federal (Ill.) smelter closed in July because of the termination of St. Joseph Lead Co. smelting contract. With the improvement in zinc prices, Tri-State Zinc, Inc., resumed full-time operation at its Timberville mine.

TABLE 7.—Mine production of recoverable silver, lead, and zinc

Year	Silver		Lead		Zinc	
	Troy ounces	Value	Short tons	Value	Short tons	Value [1]
1950–54 (average)	[2] 1,471	[2] $1,331	3,132	$907,102	13,310	$3,618,398
1955	1,850	1,674	2,997	893,106	18,329	4,508,934
1956	1,874	1,696	3,035	952,990	19,196	5,180,616
1957	1,745	1,579	3,143	898,898	23,080	5,277,476
1958	2,023	1,831	2,934	686,556	18,472	3,807,853
1959	866	784	2,770	637,100	20,334	4,661,792

[1] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.

[2] Average of 1953 and 1954 only; no output reported, 1950–52.

Manganese Ore.—Owing chiefly to termination of the Government carlot domestic manganese purchase program on August 5, Virginia production of manganese ore decreased nearly 25 percent. Although some metallurgical ore was supplied to the Government after that date, almost all mining had ceased by the yearend. Because of the cessation of the carlot buying program and the low prices for imported ores coming chiefly from Brazil and India, the outlook for continued domestic production of manganese ore seemed poor. Ten firms or individuals reported sales to the Government through the GSA program. Augusta County continued to be the leading producing county, followed by Smyth and Campbell. Other counties from which purchases through the GSA were made were Wythe, Giles, and Bland. Metallurgical-grade manganese ore, of 35 percent or more manganese content, comprised most of the production. However, a small quantity of ferruginous manganese ore was shipped for use in fertilizers. A bibliography of Virginia manganese minerals and ores was published during the year.[12]

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[12] Pegau, A. A., Virginia Manganese Minerals and Ores, A Selected Bibliography With Excerpts: Virginia Division of Mineral Resources, Min. Res. Circ. 7, Charlottesville, Va., 1958, 24 pp.

TABLE 8.—Manganese ore and manganiferous ores shipped from mines

Year	Short tons	Value	Year	Short tons	Value
1950-54 (average)	6,440	$501,295	1957	12,655	$1,057,462
1955	32,654	2,779,337	1958 [2]	8,184	648,479
1956 [1]	20,231	1,901,983	1959 [1]	6,232	499,315

[1] Incomplete total; excludes a small quantity of ferruginous manganese ore.
[2] Includes 56 tons of ferruginous manganese valued at $1,120.

Silver.—Silver was obtained as a byproduct from the zinc produced at Austinville, Wythe County. Recovery of silver from the lead concentrate shipped to the American Smelting and Refining Co. smelter at Federal, Ill., ceased in July when the smelter closed.

Titanium Concentrate.—Output of titanium concentrate (ilmenite and rutile) increased slightly. American Cyanamid Co. produced ilmenite at its Piney River (Amherst County) operation for use mainly in manufacturing titanium pigments. The Hanover County plant of Metal and Thermit Corp. continued to produce ilmenite and rutile, but because of a drop in demand for these products, the firm was changing operations to produce aplite as the primary product. However, ilmenite and rutile would continue to be recovered as byproducts.

REVIEW BY COUNTIES

The Virginia Department of Highways produced Government-and-contractor sand and gravel in 11 counties. Of this production, 62 percent was by State crews, 38 percent by contractors. Most of this material was screened or washed. Counties in which 15,000 or more tons were mined were Accomack, Hanover, Henrico, Richmond, and Russell. Other counties included Augusta, Campbell, Norfolk, Page, Pittsylvania, Rockbridge, and Shenandoah. Output of paving sand and gravel by its own crews also was reported by one county highway department (Henrico). All Government-and-contractor sand and gravel produced was consumed for paving and maintenance of roads and streets.

Albemarle.—Both granite and basalt were produced at a rate slightly less than in 1958. Charlottesville Stone Corp. (Charlottesville) mined, crushed, and screened basalt for use as concrete aggregate and roadstone. Crushed and broken granite was produced for building and highway construction by the Superior Stone Co. at its Redhill quarry (Redhill). Pit-run sand was dredged by S. L. Williamson Co., Inc., Charlottesville, for use as road material. This firm operated its plant 35 days during the year with 10 production employees.

TABLE 9.—Value of mineral production in Virginia, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value[2]
Accomack	$9,450	$9,436	Sand and gravel.
Albemarle	(3)	(3)	Stone, sand and gravel.
Alleghany	----------	(3)	Stone.
Amelia	(3)	(3)	Mica, gem stones.
Amherst	(3)	(3)	Titanium concentrate, aplite, sand and gravel, stone.
Appomattox	39,732	49,741	Stone.
Augusta	(3)	(3)	Cement, stone, manganese ore, sand and gravel.
Bedford	(3)	(3)	Stone, feldspar.
Bland	73,032	(3)	Manganese ore, stone.
Botetourt	(3)	(3)	Cement, stone, clays.
Brunswick	(3)	(3)	Stone, clays.
Buchanan	43,196,102	45,002,934	Coal, sand and gravel.
Buckingham	(3)	(3)	Stone, kyanite, clays.
Campbell	(3)	(3)	Stone, manganese ore, sand and gravel.
Caroline	----------	(3)	Sand and gravel.
Carroll	(3)	(3)	Pyrites.
Charlotte	392	----------	
Chesterfield	(3)	(3)	Sand and gravel, clays.
Clarke	16,000	(3)	Stone.
Culpeper	(3)	(3)	Stone, sand and gravel.
Cumberland	969	----------	
Dickenson	24,926,148	35,401,385	Coal.
Dinwiddie	----------	(3)	Clays.
Fairfax	3,185,218	3,944,186	Sand and gravel, stone.
Fauquier	545,760	620,346	Stone.
Franklin	(3)	(3)	Soapstone.
Frederick	1,605,788	2,147,352	Stone, lime, sand and gravel, clays.
Giles	(3)	(3)	Lime, stone, manganese ore.
Goochland	307,000	375,038	Stone.
Greensville	(3)	(3)	Do.
Halifax	935	----------	
Hanover	(3)	(3)	Stone, titanium concentrate, sand and gravel.
Henrico	(3)	(3)	Sand and gravel, stone, clays.
Henry	(3)	(3)	Stone, sand and gravel, mica.
Highland	----------	1,630	Stone.
Isle of Wight	80,099	(3)	Lime, sand and gravel.
King William	62,000	(3)	Sand and gravel.
Lee	[4] 2,061,903	2,023,649	Coal, stone.
Loudoun	(3)	(3)	Stone.
Louisa	20	----------	
Madison	231	50	Gem stones.
Mecklenburg	(3)	(3)	Stone.
Montgomery	648,137	576,647	Stone, coal, clays, sand and gravel.
Nansemond	(3)	(3)	Clays.
Nelson	(3)	(3)	Stone, aplite, soapstone.
Norfolk	(3)	(3)	Cement, lime, sand and gravel, stone.
Northampton	5,180	----------	
Northumberland	20,000	----------	
Nottoway	117,000	130,000	Stone.
Orange	(3)	(3)	Clays.
Page	14	728	Sand and gravel.
Patrick	(3)	(3)	Stone.
Pittsylvania	(3)	(3)	Stone, sand and gravel.
Powhatan	123,614	(3)	Stone.
Prince Edward	(3)	(3)	Kyanite.
Prince George	708,484	796,821	Sand and gravel.
Prince William	137,860	269,057	Clays, stone.
Princess Anne	353,785	470,489	Sand and gravel.
Pulaski	64,516	(3)	Iron ore (pigment material), stone.
Richmond	----------	19,000	Sand and gravel.
Roanoke	(3)	(3)	Stone, clays, sand and gravel, gem stones.
Rockbridge	(3)	752,809	Sand and gravel, stone, clays.
Rockingham	(3)	3,351,461	Stone, zinc, sand and gravel.
Russell	13,719,633	13,247,124	Coal, stone, sand and gravel.
Scott	[4] 11,371	330,110	Stone, coal.
Shenandoah	(3)	(3)	Lime, stone, sand and gravel.
Smyth	3,575,359	(3)	Salt, lime, stone, manganese ore, sand and gravel, clays.
Spotsylvania	(3)	(3)	Sand and gravel, stone.
Stafford	(3)	(3)	Sand and gravel.
Surry	(3)	57,900	Do.
Tazewell	18,967,626	[5] 15,186,289	Coal, stone, lime, clays, sand and gravel.
Warren	1,117,047	1,261,102	Cement, stone.
Washington	(3)	(3)	Gypsum, stone.
Wise	28,694,315	28,849,921	Coal.

See footnotes at end of table.

TABLE 9.—Value of mineral production in Virginia, by counties [1]—Continued

County	1958	1959	Minerals produced in 1959 in order of value [2]
Wythe	[6] $4,474,997	[7] $4,560,902	Zinc, lead, stone, sand and gravel, manganese ore, silver.
York	2	------------	
Undistributed [8]	[9] 54,427,655	62,867,493	
Total	[9] 203,277,000	222,304,000	

[1] The following counties did not report production: Arlington, Bath, Charles City, Craig, Essex, Floyd, Fluvanna, Gloucester, Grayson, Greene, James City, King and Queen, King George, Lancaster, Lunenburg, Mathews, Middlesex, New Kent, Rappahannock, Southampton, Sussex, and Westmoreland.

[2] Value of natural gas and petroleum included with "Undistributed".

[3] Figure withheld to avoid disclosing individual company confidential data.

[4] Coal only; value of stone included with "Undistributed".

[5] Excludes stone and clays; included with "Undistributed".

[6] Excludes stone; included with "Undistributed".

[7] Excludes manganese ore (10 to 35 percent Mn) and (35 percent or more Mn); included with "Undistributed".

[8] Includes value of natural gas and petroleum; part of value of gem stones, manganese ore (35 percent or more Mn), stone (1959), mica (1958), and sand and gravel (1958), for which commodities complete distribution by counties was not available; and values indicated by footnote 3.

[9] Revised figure.

Alleghany.—W. G. Matthews, Jr., Inc., mined and crushed limestone near Low Moor for use as concrete aggregate and roadstone.

Amelia.—W. D. Baltzley produced a small quantity of hand-cobbed and full-trimmed strategic mica from the Baltzley No. 7 mine near Amelia and sold the output to the General Service Administration Purchase Depots at Spruce Pine, N.C., and Franklin, N.H.

Amazonite was collected in the well-known Rutherford mineral-collecting area near Amelia Court House. Other minerals collected in recent years include moonstone, albite, cleavelandite, and garnet.

Amherst.—Riverton Lime and Stone Co. Division, Chadbourn Gotham, Inc., mined crude aplite at its open pit in Amherst County and processed the rock in its plant near Piney River in Nelson County. A small quantity of crushed and broken granite was prepared near Amherst for use as concrete and roadstone by the same company.

Ilmenite was mined at Piney River by American Cyanamid Co. Production continued at a high level, and the output was consumed by the company in its nearby titanium-pigment plant.

Washed and screened building sand was dredged by Smiley Sand Co. north of Lynchburg. The plant operated 280 days with an average of 8 employees.

Appomattox.—The Virginia Department of Agriculture & Immigration mined and ground limestone at a State-owned plant for agriculture.

Augusta.—Augusta Stone Corp., Belmont Trap Rock Co., Inc., and Valley Stone Co., all with quarries near Staunton, produced crushed and broken limestone for use in building and highway construction. The limestone was shipped by truck from stationary plants. Production of portland and masonry cements by Lehigh Portland Cement Co. at its Fordwick plant increased substantially over 1958. This company mined both limestone and shale for its own use. General-use and high-early-strength cement and masonry mortar cement were manufactured and marketed chiefly in Virginia, North Carolina, and West Virginia. Kilns operated at the Fordwick plant included one 11 feet in diameter and 200 feet long, and two 125-foot kilns, one 9 feet in diameter, the other 7 feet 6 inches in diameter. In addition to the limestone and shale used at the plant, other materials consumed included gypsum, mill scale, caustic, and resin.

The Virginia Highway Department produced crushed limestone for its own use in highway construction and maintenance. Virginia Department of Agriculture and Immigration mined and ground limestone near Staunton for use as agricultural stone. Katie L. Weeks produced bank-run and washed and screened sand for building. North Mountain Brick Co., at Swoope, near Staunton, remained inactive during the year.

Manganese ore containing 35 percent or more manganese was mined by South River Mining Co., Inc., the chief supplier in Virginia. The ore was obtained near Vesuvius and was purchased by GSA through the Government carlot program. Parker Manganese Co. also mined and sold to the Government manganese ore containing 35 percent or more manganese from its mine near Crimora.

Bedford.—Clinchfield Sand & Feldspar Corp. produced potash and potash-soda feldspar from five pegmatite mines in Bedford County. The crude feldspar was trucked to the company mill at Bedford and ground for use chiefly in making pottery and enamel. Most of the output was shipped to Maryland, New Jersey, New York, Ohio, and Pennsylvania. Blue Ridge Stone Co. (Blue Ridge) quarried limestone.

Bland.—Canva Mining Corp. near Bastian and Winslow Van Devanter produced manganese ore of 35 percent or more manganese content for sale to the GSA. Van Devanter ceased operating in August. The Bland Correctional Farm at White Gate quarried a small quantity of limestone for riprap.

Botetourt.—Botetourt again was the leading limestone producing county. Both quantity and value increased slightly over 1958. Three companies quarried, crushed, and sold or used over 2 million tons of limestone. These companies were James River Hydrate & Supply Co. (Buchanan), Liberty Limestone Corp. (Sherwood and Rocky Point quarries; both near Buchanan), and Lone Star Cement Corp. (Cloverdale). Cement manufacturing, concrete aggregate, and roadstone uses consumed about 65 percent of the total limestone produced. Other important uses were stone sand, agstone, asphalt and fertilizer fillers, and as an ingredient in mineral foods. Some crushed and broken stone also was used for riprap, blast-furnace flux, coal-mine rock dust, and various chemical purposes.

Botetourt County continued to rank first in value of clay production. Miscellaneous clay and shale was mined at Webster, near Roanoke, by Roanoke-Webster Brick Co., Inc., and Virginia Lightweight Aggregate Corp. for consumption in heavy-clay products and lightweight aggregate, respectively.

Lone Star Cement Corp. mined limestone at Cloverdale for use in manufacturing dry-process cement. Most of the output was general-use and moderate-heat cements, although high-early-strength cement also was produced. Purchased raw materials included sand, gypsum, mill scale, and pyrites. Distribution of portland and masonry cements was largely to Virginia, North Carolina, and West Virginia. Equipment at the plant included four 340-foot kilns, each 9 feet in diameter.

Brunswick.—Superior Stone Co. purchased the former Rawlings quarry of the Bryan Rock & Sand Co. and continued to mine, crush, and screen granite for use as roadmaking material. Brick & Tile Corp. (Lawrenceville) mined miscellaneous clay and shale for use in making building brick.

Buchanan.—Buchanan County continued to rank first among coal-producing counties in Virginia, and output rose 8 percent to over 10.3 million short tons. More than 35 percent of the Virginia coal production was mined from the 742 active mines in the county. Virtually all the coal was mined underground, although small quantities were mined at strip and auger mines. Leading producers included Harman Mining Corp. (Harman mine), Island Creek Coal Co. (Keen Mountain mine), Jewell Ridge Coal Corp. (No. 2 mine), and Sycamore Coal Co. (Buccaneer mine). These producers recovered coal from the Splashdam, Jewell, and Cary seams, respectively.

The United Fuel Gas Co., United Producing Co., and Clinchfield Coal Co. completed five natural gas wells in Buchanan County. Formations drilled were the Berea sand, Devonian shale, and Ravencliff sand. Distribution of the gas produced was almost entirely through pipelines of the Hope Natural Gas Co.

Matney Sand Co. recovered sand at a stationary plant near Grundy for use in building and paving.

Buckingham.—Le Sueur-Richmond Slate Corp., Arvonia-Buckingham Slate Co., Inc., and Williams Slate Co., all near Arvonia, produced dimension slate for roofing, flagging, structural, and sanitary uses. The latter two companies sold their products through Buckingham-Virginia Slate Corp., Richmond, Va. Slate roofing granules were produced by Blue Ridge Slate Corp. from its Dutch Gap quarry near New Canton. Quantity and value of slate produced increased slightly.

Kyanite Mining Corp. produced kyanite at its Willis Mountain mine and Dillwyn mill for use in special refractories and other ceramic products.

Solite Corp., formerly Southern Lightweight Aggregate Corp., mined and processed miscellaneous clay and shale at Bremo Bluff near New Canton for consumption in manufacturing lightweight aggregate.

Campbell.—Rough and dressed building stone, flagging, and crushed and broken stone (scrap from dimension stone preparation) were marketed by Virginia Greenstone Co., Inc. (Lynchburg), under the trade name "Virginia Greenstone". A small quantity of refractory stone was sold as bakery-oven hearthstone. Limestone was quarried and crushed for use as concrete aggregate and roadstone by Blue Ridge Stone Corp. (Lynchburg) and Rockydale Stone Service Corp. (Concord). Shipments were mostly by motor truck, although small tonnages were shipped by railroad.

General Services Administration reported small purchases of manganese ore containing 35 percent or more manganese from William H. Irvine, Evington.

Caroline.—Dyson Sand & Gravel Co. (Milford) produced building sand at its stationary plant. Mattaponi Sand and Gravel Co., produced paving gravel near Beulahville.

Carroll.—General Chemical Division, Allied Chemical Corp., produced lump ore and fine pyrite concentrate as a source of sulfur for its chemical plant in Pulaski, from the Gossan mine near Galax.

Chesterfield.—Although output of sand and gravel in Chesterfield County was 2 percent less than in 1958, Chesterfield County remained third among sand-and-gravel-producing counties. Southern Materials Co., Inc., produced sand and gravel for building and paving, and filter sand from its Kingsland Reach dredge operations in the James River. The company worked 280 days, employing 57 men at its dredge and preparation plant. About two thirds of its products was shipped by barge. Redford Brick Co., Richmond Clay Products Corp., and the Southside Brick Works, Inc., all in or near Richmond, produced miscellaneous clay or shale at open-pit mines for use in manufacturing of building brick.

Clarke.—Calcareous marl was produced for agriculture by J. C. Digges & Son, at its Old Chapel lime marl plant (White Post), and by Elmer Kenney Lime Co. (Berryville). This material was mined, pulverized, and air dried before sale.

The Commonwealth of Virginia Highway Department reported production of crushed and broken limestone for use in highway construction and maintenance.

Culpeper.—Quartzite for concrete aggregate and road material was mined and crushed by Culpeper Stone Co., Inc., near Culpeper. Washed and screened building and paving sand were produced by Culpeper Sand Co. Four men were employed at the plant for 250 days.

Dickenson.—Dickenson County rose to second place among coal-producing counties, surpassing Wise County by nearly 20 percent in tonnage. Number of mines totaled 114; 97 percent of the tonnage came from underground mines. Increased production in Dickenson County was due chiefly to the increased output at the Moss No. 3 mine of the Clinchfield Coal Co. In its first full year of operation (1959) it produced nearly 3.2 million short tons of bituminous coal and was the third largest mine in the United States; 88 percent of the tonnage was shipped by rail. Leading producers in the county were Clinchfield Coal Corp. (six underground mines), Baker Coal Co. (one underground mine), and Wisco Coal Co. (one strip mine).

The Clinchfield Coal Co. produced natural gas from the Devonian shale and the Big Lime formations for marketing through the pipeline of the Kentucky-West Virginia Gas Co.

Dinwiddie.—Daniels Brick & Tile Co., Inc. (Dinwiddie), produced shale for manufacturing heavy clay products.

Fairfax.—Production of sand and gravel increased 27 percent in tonnage over 1958. The county was second among sand-and-gravel-producing counties in the State. Eight companies produced sand and gravel entirely for use in building and highway construction. About 80 percent of the total output was washed, screened, or otherwise prepared. Nearly all the bank-run, unwashed material was used for paving. The chief producers were Virginia Sand & Gravel Co., Inc., L. S. Sorber & Co., Northern Virginia Construction Co., Inc., Modern Sand & Gravel Corp., and Alexandria Sand & Gravel Corp. All the above firms produced their material from stationary plants, except L. S. Sorber & Co., which used portable equipment.

Basalt was mined and processed for building and highway construction by Fairfax Quarries Inc. near Fairfax. Graham Virginia Quarries, near Occoquan, mined and prepared crushed and broken granite for use as riprap, concrete aggregate, roadstone, and railroad ballast. As of January 1, 1960, this firm was merged into Vulcan Materials Co., Birmingham, Ala., and was to operate as the W. E. Graham & Sons Division of Vulcan Materials Co. Herbert Bryant, Inc. (Alexandria), recovered oystershell for use as poultry grit and for burning into lime.

Fauquier.—W. W. Sanders (Warrenton) and Riverton Lime & Stone Co. Division, Chadbourn Gotham, Inc. (Paris), produced crushed basalt for building and highway construction. James Edward Corum, at the Halls quarry near Broad Run, and J. W. Costello at the Costello quarry near The Plains, continued to mine sandstone for use as flagging, rubble, building facing, and bridges. Millbrook Quarries, Inc. (Broad Run) quarried and crushed limestone for use as roadstone and concrete aggregate.

Floyd.—The topography, geomorphology, and a detailed description of the petrology and structure of rocks in Floyd County were presented in a comprehensive report.[13] All known occurrences of minerals also were reported and described in a section on the economic geology of the county. Although there was no mineral production in 1959, past output included arsenic, copper, iron ore, and dimension and crushed stone. Crushed stone for local use as roadstone held the most promise for future production.

Franklin.—Blue Ridge Talc Co., Inc., continued to mine soapstone at its King-Ramsey mine near Henry. The output was sold for use in foundry facings and insecticides. The Blue Ridge Talc Co., Inc., produced a wide variety of manufactured iron oxide pigments at its Henry plant.

Frederick.—Frederick County ranked fourth in production of limestone; output increased more than 40 percent over 1958. Two companies operating three quarries were active. The M. J. Grove Lime Co., Inc., at its Stephens City and Middleton quarries, prepared crushed limestone and dolomite, respectively, for blast-furnace and open-hearth flux, concrete aggregate and roadstone, agriculture, stone sand, glassmaking, rock dust for coal mines, and other uses, including cement and lime manufacture. Stuart M. Perry, Inc., produced crushed limestone from a quarry at Winchester for use in building and paving and as agricultural stone and stone sand.

Lime produced at the Stephens City plant of the M. J. Grove Lime Co., Inc., was consumed for metallurgical uses, mason's lime, water purification, and other general chemical uses. Distribution was mostly to Virginia and Pennsylvania. The Stephens City lime plant consisted of seven shaft kilns, an Azbe-type vertical shaft, a batch hydrator, and a continuous hydrator. Fuel was natural gas.

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[13] Dietrich, Richard V., Geology and Mineral Resources of Floyd County of the Blue Ridge Upland, Southwestern Virginia: Virginia Polytechnic Inst. Eng. Exp. Sta. Ser. 134, Blacksburg, Va., 1959, 160 pp.

Glass sand was produced near Gore by Virginia Glass Sand Corp. and processed at the nearby plant of the Shenandoah Silica Co., Inc. All shipments of glass sand were by rail. A small quantity of sand for building and paving also was produced. Shale was mined by Shenandoah Brick & Tile Corp. near Wincester for use in making building brick.

Giles.—Giles County ranked third in production of limestone in Virginia, yielding second place to Rockingham County. Virginia Limestone Corp. produced crushed and broken dolomite at its Ripplemead quarry for use as metallurgical flux, concrete aggregate and roadstone, railroad ballast, and stone sand. National Gypsum Co. and Standard Lime & Cement Co., Division of American-Marietta Co., both near Kimballton, produced captive limestone chiefly for use in manufacturing lime. Ripplemead Lime Co., Inc. (Ripplemead) operated its limestone quarry and lime kiln intermittently during the year. The lime plant consisted of one shaft kiln and one continuous hydrator and was fired by bituminous coal. Hydrated lime was produced for use in water softening and mason's lime.

Lime produced at the Kimballton plant of the National Gypsum Co. was consumed in manufacturing mason's lime, as agricultural lime, and for many chemical and other industrial uses. Both quicklime and hydrated lime were produced. Distribution was mostly to Virginia and other southern States. The lime plant comprised three rotary kilns and continuous hydrators. Bituminous coal was used as fuel. Standard Lime & Cement Co., Division of American-Marietta Co., produced quicklime, which was used in manufacturing calcium carbide and cyanamid, for paper refining, and for other chemical uses. Distribution was largely to West Virginia and other southern States. Bituminous coal was used to fire two rotary lime kilns.

Monterey Mining Co. of Newport produced manganese ore from the Reynolds mine until August, when the operation was discontinued owing to termination of the government carlot purchase program.

Goochland.—Boscobel Granite Corp. mined and processed granite from an open quarry at Manakin for use in building and roads. About two-thirds of the output was shipped by waterway and the remainder by truck. Royal Stone Corp. produced crushed quartzite for road material from its quarry near Rockville.

Greensville.—Granite, chiefly for use as concrete aggregate and roadstone, was mined and prepared by Trego Stone Corp. (Skippers). Railroad ballast and riprap also were sold. Over 60 percent of the granite marketed was shipped by railroad and the remainder by truck.

Hanover.—Small quantities of ilmenite and rutile were produced at Montpelier near Beaverdam by Metals and Minerals Division of Metal & Thermit Corp. This firm was changing its process to make aplite the chief product, and ilmenite, rutile, mica, and titanite as byproducts.

The J. E. Baker Co., at its Verdon quarry near Doswell, produced crushed and broken basalt for use as riprap, railroad ballast and concrete aggregate, and roadstone. Over three quarters of the tonnage produced was shipped by rail and the remainder by truck.

Henrico.—Sand and gravel produced in Henrico, by far the leading producing county, totaled more than 2.6 million tons. The product was washed and screened and was consumed in building and paving and as filter and fill sand. Three large producers, two with stationary plants and one portable, were Commonwealth Sand & Gravel Corp., West Sand & Gravel Corp., Inc., and Southern Material Co., Inc., all in or near Richmond. Total employees at these 3 operations were 134 (including 21 officeworkers). Hours worked totaled 331,500. Most of the sand and gravel produced in the county was shipped by water.

Crushed and broken granite was marketed by the Tidewater Crushed Stone Co. for use as concrete aggregate and building stone from a stationary plant in Richmond. Some riprap also was prepared. Daniels Brick & Tile Co., Inc., produced drain tile, flue linings and fittings from river clay, also in Richmond.

Henry.—Snyder Stone Quarry and Martinsville Stone Corp. produced crushed and broken granite for use in building and highway construction from stationary plants near Martinsville. A small tonnage of building sand and gravel was produced.

Small quantities of full-trimmed strategic mica were mined from the Roberts, Eanes, and Mills mines and sold to GSA Purchase Depots at Franklin, N.H., and Spruce Pine, N.C.

Highland.—The Virginia Highway Department produced crushed limestone for its own use in road construction and maintenance.

Isle of Wight.—Battery Park Fish & Oyster Co. (Battery Park) burned oystershell into agriculture lime. Most of the finished material was shipped by truck, although sizeable quantities were shipped by water. A small tonnage of fill gravel was produced by Dudley C. Waltrip.

King William.—Fox Co. produced building sand and gravel near Aylett.

Lee.—Production of coal from 69 mines increased 24 percent over 1958. Underground mines produced 83 percent of the tonnage. Several strip and auger mines also were active. Leading producers in the county were Betsy Darby Coal Co. (Betsy Darby mine), Virginia Lee Co., Inc. (Virginia Lee mine), and Wisco Coal Co. (Wisco No. 2 mine).

The sole oil-producing area in Virginia was the Rose Hill Field in Lee County in the extreme southwest corner of the State. The output was consumed locally.

Kentucky-Virginia Stone Co., Inc. (Gibson Station) and Woodway Stone Co. (Woodway) quarried and processed limestone for use as railroad ballast and concrete aggregate and roadstone. Most of the limestone was shipped by rail and the remainder by truck.

Loudoun.—Owing chiefly to the construction of the new international airport near the District of Columbia, where basalt or diabase was used in constructing runways and other roadways at the airport, production of this stone was over 240 percent greater than in 1958. Three companies shared in the increased output—Arlington Stone Co., Virginia Trap Rock, Inc., (both near Leesburg), and a new firm, Chantilly Crushed Stone Co., Arcola. A sizeable proportion of the tonnage produced was shipped by rail and the remainder by truck. A small quantity was sold for riprap. Crushed and broken granite was marketed for use as building and roadstone by Bull Run Stone Co. (Manassas). Limestone for road material was produced at the Palmer quarry near Leesburg by Virginia State Highway Department.

Madison.—Unakite and epidote were found by several mineral collectors near Syria in the Rose River area.

Mecklenburg.—W. E. Graham & Sons Division, Vulcan Materials Corp., produced concrete aggregate and roadstone from Buggs Island quarry near Boydton, formerly owned by Marks-Wicker Co., Inc. Greystone Granite Quarries also produced prepared granite for building and roadstone.

Montgomery.—Montgomery Limestone Corp. (Ellett) and Radford Limestone Co., Inc. (Radford) produced and sold limestone for use as concrete aggregate and roadstone and as agricultural limestone. Part of the output of the Radford firm was sold for railroad ballast, stone sand, and road maintenance sand.

Velvet Sand Co., Inc., mined and crushed sandstone for use as concrete aggregate and roadstone and as filler. This firm also mined and prepared washed and screened sand for building construction and fill from a stationary plant near Radford. Building brick was manufactured from shale mined at Elliston near Salem by Old Virginia Brick Co., Inc.

A small quantity of semianthracite was produced in Montgomery County by two deep mines for consumption mostly in domestic heating.

Nansemond.—Lone Star Cement Corp. mined calcareous marl at Chuckatuck for use in its cement plant at South Norfolk, Norfolk County. Miscellaneous clay was mined near Suffolk by Roanoke-Webster Brick Co., Inc., for use in manufacturing building brick.

Nelson.—Consolidated Feldspar Department of International Minerals and Chemical Corp. continued to recover crude aplite in its open-pit mine near Piney River. Both this company and the Riverton Lime & Stone Co., Division, Chadbourn Gotham, Inc., treated crude aplite in plants near Piney River, where the material was crushed, ground, and sized for use in glass manufacture and as roofing granules. Principal markets for the finished product were in Illinois, Louisiana, New Jersey, New York, Ohio, and West Virginia. Buffalo Mines, Inc., completed preparation of its open-pit mine and construction of its treatment plant in the Piney River District late in 1959. Operations were begun, but only a small quantity of aplite was mined and ground during the shakedown period.

Alberene Stone Division of the Georgia Marble Co. produced ground and dimension soapstone. The ground material was sold as a filler material in roofing and rubber compositions and for roofing granules. Dimension soapstone was sold for laboratory and architectural applications and for flagging. The quarry and mill were near Schuyler. Shipments were entirely by rail.

Norfolk.—Calcareous marl and clay mined in Nansemond County by Lone Star Cement Corp. was used in making cement at South Norfolk. General-use portland cement was shipped mostly within the State, although some was shipped to North Carolina. The cement plant consisted of three 219-foot kilns, each 7 feet in diameter at the upper end and 7⅔ feet at the lower end. Operations were essentially continuous throughout the year. Sand and gravel for use as building and paving material and for railroad ballast was produced near Norfolk by Interstate Sand & Gravel Co.

Ballard Fish & Oyster Co., Inc., sold shell for use in filter beds, and J. H. Miles Co., Inc., of Norfolk sold shell to Reliance Fertilizer & Lime Co., which manufactured hydrated agricultural lime from the shell. Most of the oystershell recovered was returned to the oysterbeds for replanting purposes.

United States Gypsum Co. calcined domestic and imported gypsum at a plant at Norfolk for use in plaster and other products. Several fertilizer plants in and near Norfolk prepared uncalcined gypsum imported from Nova Scotia for sale as a land dressing.

Nottaway.—Burkeville Stone Co., Inc. (Burkeville), mined and prepared granite for use in building and road construction at a stationary plant near Burkeville.

Orange.—Miscellaneous clay was mined near Orange by Roanoke-Webster Brick Co., Inc., for use in making building brick.

Patrick.—Granite was quarried by A. C. Wilson Construction Co. near Patrick Springs for use as concrete aggregate and roadstone. The company operated both stationary and portable plants.

Pittsylvania.—Barnes Stone Co., Inc., produced granite for concrete aggregate and roadstone at a quarry near Danville. A new quarry, also producing crushed and broken granite for building and road construction, was opened by Superior Stone Co., near Danville. The city of Danville produced crushed and broken granite for use in street and road maintenance. Washed and screened sand for building construction, fill, and paving was produced by Kendall Sand Works and Marshall Sand Co., both of Danville.

Solite Corp. (formerly Southern Lightweight Aggregate Corp.) continued to manufacture lightweight aggregate near Leaksville Junction, from a miscellaneous clay deposit just over the State line in North Carolina.

Powhatan.—Crushed and broken granite was prepared by Virginia Stone & Construction Co. for use as road-construction material from its Genito quarry near Powhatan.

Prince Edward.—Kyanite Mining Corp. continued to operate its Baker Mountain mine and Cullen flotation plant to produce beneficiated kyanite for use in manufacturing high-temperature refractories and special ceramic bodies.

Prince George.—Prince George County ranked fourth among sand-and-gravel-producing counties in the State. Friend Sand & Gravel Co., Inc., and Bryan Rock & Sand Co. (owned by Southern Materials Co.) produced sand and gravel for building and paving purposes. Southern Materials Co., Inc. also operated its Puddledock pit, producing building and paving sand and gravel and sand fill. Production at these three plants was all prepared material. Hitch Gravel Corp. produced pit-run gravel for use as paving material.

Nitrogen compounds used in fertilizer were manufactured at Hopewell by Nitrogen Division, Allied Chemical Corp. Products included solid and solution ammonium nitrate, ammonia, ammonium nitrate-limestone, urea solutions, and other nitrogen compounds.

Virginia Perlite Corp., Hopewell, continued to produce expanded perlite from raw material mined out of State for use in building plaster and concrete aggregate.

Princess Anne.—Production of sand increased 53 percent. Six companies, including two using dredges near Oceana and Little Creek, produced sand chiefly for building and highway construction and fill. Prepared sand for fertilizer filler, molding, grinding, polishing and engine uses, and filtration also was produced. A small quantity of ground sand was prepared for foundry use.

Prince William.—After mining clay throughout the year at Woodbridge for use in manufacturing heavy clay products including building brick, the Woodbridge Clay Products Co. discontinued operations at the location in December. A new mine and mill were begun in April at Manassas in the same county to produce clay for building brick.

Diabase (basalt) was produced by Gainesville Stone Quarry, Inc., for use as roadstone and concrete aggregate from a quarry near Gainesville.

Pulaski.—The American Pigment Corp. mined sienna, umber, natural yellow iron oxide, and ocher, which were finished at its nearby plant at Hiwassee. The same company manufactured red and yellow oxide pigments at its Pulaski plant.

Crushed limestone was produced by the city of Radford at a quarry near Radford for use in road construction and maintenance.

Roanoke.—Limestone for concrete aggregate, roadstone, and agriculture was produced by Rockydale Quarries Corp. near Roanoke. Building sand was produced near Salem by Marl and Stone Corp. Building brick was made from shale mined and processed by the Old Virginia Brick Co., Inc., near Salem. Cave onyx was collected by gem-stone hobbyists near Roanoke.

Rockbridge.—Crushed and broken quartzite was mined and prepared for use in manufacturing ferrosilicon by W. G. Mathews, Jr., Inc., at a quarry near Greenlee in the southern part of the county. Crushed limestone was produced by Lone Jack Limestone Co. from its Glasgow quarry for use as concrete aggregate, roadstone, and railroad ballast.

Washed and screened sand was produced near Glasgow by Locher Silica Corp. Sizable quantities of building and engine sand were also prepared and marketed. Locher Brick Co., Inc., manufactured building brick from surface (miscellaneous) clay mined near Glasgow.

Rockingham.—Rockingham was the second ranking county in limestone production. R. Y. Frazier and Fred Betts, III, mined and crushed limestone for concrete aggregate, roadstone, and agricultural stone at quarries near Harrisonburg. Limestone also was produced by C. S. Mundy Quarries, Inc. (Broadway), for use as concrete aggregate, agricultural limestone, and in making lime. The Virginia Highway Department produced sizable quantities of limestone for road construction and maintenance. Jamison Black Marble Co., Inc., mined and crushed stone at its quarry near Harrisonburg, chiefly for use as terrazzo.

The Tri-State Zinc Co., near Timberville, resumed full-time operations at its Bowers-Campbell mine and mill in early 1959. The higher price for zinc was an important factor in the resumption of activities. Flotation zinc concentrate averaging 60.46 percent zinc was shipped to the St. Joseph Lead Co., Josephtown, Pa., smelter.

Russell.—Production of coal decreased slightly compared with 1958. Most of the production came from underground mines, although sizable tonnages were produced at strip and auger mines. Fifty-eight mines were active during the year. Leading coal producers were

Clinchfield Coal Co. (four underground mines), Smith Coal Co. (one underground mine), and Stallard Lawson Coal Co. (one strip and one auger mine).

Clinch River Quarries (St. Paul) mined and processed limestone for building and highway construction. The Virginia Department of Highways also produced limestone for concrete aggregate and roadstone. Paving sand and railroad ballast gravel also were produced.

Scott.—Limestone produced from an underground mine at Duffield was used as a reagent in the manufacture of lithium hydroxide at the Foote Mineral Co. lithium refining plant at Sunbright. Spodumene (lithium ore) refined in this plant was obtained near Kings Mountain, N.C. Penn-Dixie Cement Corp. produced limestone at Speers Ferry for use in manufacturing cement at its plant near Kingsport, Tenn. Blountville Construction Co. produced crushed limestone at its Tri-State Lime Quarry for concrete aggregate, roadstone, agricultural stone, fertilizer filler, and filtration purposes. Limestone for road material and concrete aggregate was mined and crushed by Natural Tunnel Stone Co. (Clinchport).

Two underground mines increased production of bituminous coal, although total output was relatively small.

Shenandoah.—Chemstone Corp., Dominion Division (Strasburg), mined and crushed limestone chiefly for metallurgical flux, and for manufacturing hydrated lime at its own plant. Shipments of lime mainly were to Ohio and Pennsylvania and were consumed by open-hearth and electric steel furnaces, sewage treatment plants, tanneries, papermills, and water-purification plants. A small quantity was consumed as mason's lime. The Chemstone plant used natural gas for fuel and consisted of four shaft kilns and continuous hydrators. Aside from the burning of lime, limestone mined by Chemstone was used as blast furnace and open hearth flux, as asphalt filler, and for other purposes.

W. S. Frey Limestone Quarry at Strasburg Junction was no longer in operation. Small sales, however, were made from the stockpile. Limestone was mined and crushed by Toms Brook Lime & Stone Co., Inc. (Toms Brook) and C. S. Mundy Quarries, Inc. (Timberville), for agriculture, and for concrete aggregate and roadstone. Crushed limestone was prepared by Shenandoah Valley Lime & Stone Corp. (Strasburg), for use as blast furnace and open-hearth flux. Shipments of this stone were entirely by rail.

Smyth.—Brine recovered from underground salt deposits and lime burned from limestone produced from its own quarry were the raw materials used by Olin-Mathieson Chemical Corp. (Saltville) to produce chlorine, soda ash, and other chemicals. The lime plant consisted of 3 rotary kilns and 14 vertical kilns. Both bituminous coal and coke were used as fuel. This company also sold a small tonnage of limestone for use as concrete aggregate. Holston River Quarry, Inc. (Marion), Rockydale Hardrock Co. (Sugar Grove), and E. P. Ellis (Marion) produced crushed limestone for building and highway construction.

Sayers Land Co. and C. R. Snyder & Sons produced washed sand and gravel for use in paving and building construction. Appalachian Shale Products Co. mined shale at Groseclose, north of Marion, for use in making building brick.

National Manganese Co., Inc., Marion, and Wilson Wide-Lite Co., Rural Retreat, mined manganese ore of 35 percent or more manganese content for sale to the government through the GSA. Output ceased after termination of the government carlot purchase program.

Spotsylvania.—Crushed and broken granite was prepared by Fredericksburg Stone Co. from its quarry near Fredericksburg for use as riprap, concrete aggregate, and roadstone. Washed and screened sand and gravel for use in building and paving construction was produced by Massaponax Sand & Gravel Corp. near Fredericksburg.

Surry.—Friend Sand & Gravel Co. produced paving and building sand and gravel from pits in Surry and Sussex Counties (separate output for each county was not reported).

Tazewell.—Coal produced was 9 percent less than in 1958, and the county dropped to fifth place among coal-producing counties. Active mines totaled 36, of which 25 were underground mines; 41 mines were active in 1958. About 94 percent of the coal mined was from underground mines. Leading producers were Pocahontas Fuel Co., Inc. (Amonate, Bishop, Jenkinjones, and Boissevain mines), Alfredton Coal Co. (Alfredton mine), Wildcat Coal Co. (Nos. 1 and 5 mines), and Rebecca Coal Co. (Rebecca mine).

Blue Grass Lime Co. (Tazewell) and Peery Lime Co., Inc. (North Tazewell), mined limestone and burned it into lime for local consumption. Two pot kilns were operated by Blue Grass Lime Co. and four pot kilns by Peery Lime Co., Inc. Lime produced by the Blue Grass Lime Co. and the Peery Lime Co., Inc., was consumed mostly for building and agricultural purposes. A small amount of concrete aggregate was sold by Peery Lime Co., Inc. Pounding Mill Quarry Corp. opened a new limestone quarry near Bluefield. This new quarry and its Pounding Mill Quarry produced limestone for concrete aggregate, roadstone, metallurgical and agricultural purposes, for coal mine rock dust, and use as stone sand. Most of the output of these two quarries was shipped by truck, and the remainder by rail.

General Shale Products Corp. produced miscellaneous clay and shale from its Richland open-pit mine for consumption in the manufacture of heavy clay products, chiefly building brick. Paving sand and gravel also were produced.

Warren.—Limestone mined by Riverton Lime & Stone Co. Division, Chadbourn Gotham, Inc., at its No. 5 and Shale quarries was used in the manufacture of masonry cement, for building construction and highway maintenance, as agricultural stone, railroad ballast, and for other purposes. The masonry cement, manufactured at the company plant at Riverton, was consumed mostly in Virginia.

Washington.—Limestone was mined and crushed for use as concrete aggregate, roadstone, and agricultural stone by Lambert Bros., Inc., Division of Vulcan Materials Co. (Bristol) and Meadowview Lime Co. (Meadowview).

The only gypsum mine in the State was operated by United States Gypsum Co. at Plasterco. The company also operated a plasterboard plant there.

Wise.—Although output of bituminous coal increased slightly, the county dropped to third among the State's coal-producing counties. Of the 255 mines active during the year, 220 were underground, 23 were strip, and 12 were auger mines. The county ranked first in production of strip-mined coal, with output totaling 1.3 million tons. This was 21 percent of the total production for the county, and 75 percent of the total strip coal mined in the State. Underground mines accounted for 75 percent, and auger mines for 4 percent of the county total. Principal producers were: Stonega Coke & Coal Co. (six underground mines, two strip mines, and two auger mines), Coal Processing Corp. (one underground mine), Wise Coal & Coke Co. (one underground mine), Stallard-Womack Coal Corp. (one strip and one auger), Stamack Mining Corp. (one strip and one auger), and Sunrise Coal Co. (one underground mine).

Clinchfield Coal Co. produced a small quantity of natural gas from the Big Lime formation.

Wythe.—Recoverable lead and zinc were produced at Austinville from a mill handling the outputs of both the Austinville and Ivanhoe mines. The Ivanhoe mine which had been shut down for 13 months, resumed operations in September. At the end of the year, the mill returned to almost full capacity, handling ore from both mines. Metal was recovered at various smelters including those at Palmerton, Pa., and East Chicago, Ind. Output of silver, which had been obtained as a byproduct of the smelting of lead concentrate at a Federal, Ill., smelter, was curtailed because of termination in July of the smelting contract of the American Smelting & Refining Co. with St. Joseph Lead Co. Limestone recovered as a byproduct of lead and zinc mine operations at Austinville was sold chiefly for agriculture and fertilizer filler.

Limestone was mined and crushed by Pendleton Construction Corp. (Wytheville) and H. D. Crowder & Sons (Austinville) for use in highway and building construction. Prepared paving sand was produced by Silica Products Co. at a stationary plant near Wytheville.

Simmons Associates Mining Co., Washington, D.C., mined manganese ore of 35 percent or more manganese content in Wythe County. This ore was of metallurgical type and was sold to the GSA. Some ore of 10 to 35 percent manganese content also was produced by this firm.

The Mineral Industry of Washington

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Washington Division of Mines and Geology.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and A. J. Kauffman, Jr.[2]

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MINERAL production in Washington in 1959 was valued at $63.9 million, 5 percent more than in 1958. The higher values of stone and cement, and, to a lesser extent, of lead, gold, and magnesite more than offset lower values of sand and gravel. Twenty-seven mineral commodities were produced. Their value was the highest since 1955, when the annual total for the State reached a record of $67.3 million. An increase in building construction in the last quarter of 1958 continued into 1959, but a slowdown in highway construction was an important factor in the decline in output of sand and gravel. More than one-half of the sand and gravel output was used in roadbuilding and maintenance.

Uranium mining activities in the northeastern section of Washington were unchanged, and output of lead-zinc ore in that area was higher than in 1958. Two gold mines in the State produced during the year and were among the eight principal gold-lode mines in the Nation.

Trends and Developments.—Plans were announced for expansions in the cement industry, and a new brick plant was completed. Prospects were good for building new petroleum refineries in the western part of the State. The Bonneville Power Administration of the Department of the Interior announced that the $17.50-a-kilowatt-year rate, in effect since 1938, would be continued until the end of 1964. Expansion of facilities in the steel industry at Seattle continued in 1959. The steel producers used scrap as the principal raw material. State agencies began a program to determine the feasibility of establishing an iron-ore smelting industry.

The Washington Business Index of the Seattle First National Bank increased 9 percent to 152.4 (1947–49=100), indicating good recovery from the 1958 recession despite dwindling employment in defense industries. The index reflected changes in employment and bank debits.

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Employment and Injuries.—Employment data were compiled from bulletins of the Washington Employment Security Department. Curtailments continued at primary aluminum plants during much of the year, resulting in low employment compared with employment 1952–57. The number of workers in other plants processing nonferrous

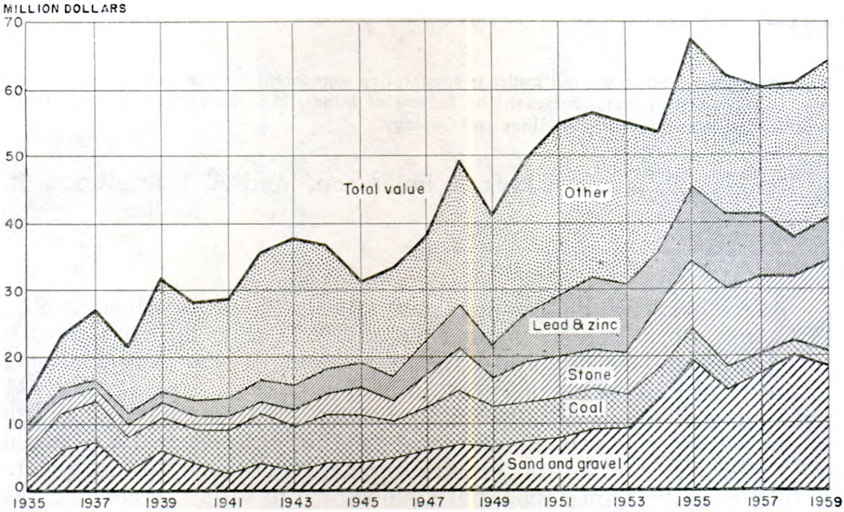

FIGURE 1.—Value of sand and gravel, coal, stone, lead and zinc, and total value of mineral production in Washington, 1935–59.

TABLE 1.—Mineral production in Washington [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousand)	Short tons (unless otherwise stated)	Value (thousand)
Chromium ore and concentrate ---------- gross weight --	17	$2	------------	------------
Clays [3] ---------- thousand short tons --	196	183	180	$171
Coal ---------- do ----	252	1,968	242	1,841
Copper (recoverable content of ores, etc.) ----------	52	27	49	30
Iron ore (usable) ---------- thousand long tons --	4	(2)	4	5
Lead (recoverable content of ores, etc.) ----------	9,020	2,111	10,310	2,371
Manganese ore and concentrate (35 percent or more Mn). gross weight --	------------	------------	83	(2)
Peat ----------	34,642	116	32,884	124
Pumice ---------- thousand short tons --	(2)	(2)	9	112
Sand and gravel ---------- do ----	24,389	20,086	21,360	18,576
Stone ---------- do ----	7,837	9,991	12,278	13,587
Talc and soapstone ----------	4,000	21	4,073	23
Uranium concentrate (oxide content) ---------- pounds --	(2)	(2)	488,360	(2)
Zinc (recoverable content of ores, etc.) ----------	18,797	3,835	17,111	3,936
Value of items that cannot be disclosed: Abrasive stone (grinding pebbles), barite, carbon dioxide, cement, diatomite, gem stones, gypsum, gold, magnesite, mercury (1958), olivine, petroleum, silver, strontium, and values indicated by footnote 2 ----------	------------	24,204	------------	25,054
Total Washington [4] ----------	------------	60,896	------------	63,894

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Figure withheld to avoid disclosing individual company confidential data.

[3] Incomplete totals, fire clay included with items that cannot be disclosed.

[4] Total adjusted to eliminate duplicating value of clays and stone; 1958 total revised.

minerals (mainly copper smelting plants) dropped as the result of strikes. Work stoppages also affected the steel industry for several months; however, employment in the mineral industry was slightly higher than in 1958. The following industries recorded increases in employment: Stone, clay, and glass products; industrial chemicals;

TABLE 2.—Average monthly employment and total wages in the mineral industries[1]

Industry	1958		1959	
	Employment	Wages (thousands)	Employment	Wages (thousands)
Mining:				
Metal mining	585	$3,215	597	$3,673
Bituminous coal, crude petroleum, and natural gas	410	2,059	292	1,700
Nonmetallic mining and quarrying	863	4,785	859	5,099
Total	1,858	10,059	1,748	10,472
Stone, clay, and glass products:				
Cement, hydraulic	650	3,608	695	4,093
Structural clay products	408	2,027	333	1,797
Concrete, gypsum, and plaster products	3,180	17,820	3,409	20,272
Other	731	3,942	777	4,448
Total	4,969	27,398	5,214	30,610
Smelting, refining, and casting:				
Blast furnaces, steel works, rolling and finishing mills	1,889	11,347	1,932	12,281
Iron and steel foundries	819	4,480	947	5,369
Smelting, refining, and casting of nonferrous metals, except aluminum	1,018	5,451	681	3,735
Smelting, rolling, drawing, and casting of aluminum	6,722	43,836	6,592	43,912
Miscellaneous	51	273	70	425
Total	10,498	65,388	10,222	65,722
Industrial chemicals[2]	9,260	64,840	9,343	68,749
Petroleum refining and related industries	1,370	8,832	1,531	10,191
Grand total	27,955	176,517	28,058	185,744

[1] Washington Employment Security Department bulletins; industry groups may vary from those in the Bureau of Mines canvass.
[2] The Hanford atomic installation is the largest in this classification.

TABLE 3.—Injury experience in the mineral industries

1958	Men working daily	Average active days	Man-hours worked	Fatal injuries	Nonfatal injuries	Injuries per million man-hours
Quarries and mills[1]	1,601	212	2,715,577	1	34	13
Nonmetal mines and mills	209	185	309,131		8	26
Sand and gravel operations	779	185	1,151,008		26	23
Metal mines and mills	442	247	874,351		37	42
Coal mines	296	160	377,852	1	22	61
Total	3,327	204	5,427,919	2	127	24
1959[2]						
Quarries and mills[1]	1,051	231	1,939,706		13	7
Nonmetal mines and mills	171	195	267,155		7	26
Sand and gravel operations	786	205	1,291,937	1	11	9
Metal mines and mills	499	229	914,304		40	44
Coal mines	283	200	452,693		29	64
Total	2,790	218	4,865,795	1	100	21

[1] Includes cement- and lime-processing plants.
[2] Preliminary figures.

and petroleum refining. Mining employment was steady except for coal mining, which reported a drop.

Injury statistics for the Washington mining industry (table 3) are based on reports to the Bureau of Mines from individual companies.

Government Programs.—There was only one active contract with the Office of Minerals Exploration (OME) program to encourage exploration for strategic and critical minerals. The contract, dated March 19, 1958, for $11,620 with 50-percent government participation, was for work at the Mint copper claims in Snohomish County.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Grinding pebbles were produced from a deposit near Chewelah, Stevens County, by Manufacturers Mineral Co. at about the 1958 rate. The pebbles were used at the company Seattle plant.

Barite.—Production of barite declined sharply from 1958. The Natural Stone Co. mine near Valley, Stevens County, was the only producer during the year. Manufacturers Mineral Co. shipped a small quantity of barite from stocks at the Madsen mine, Stevens County.

Cement.—Combined output of portland and masonry cement was 17 percent above output in 1958; shipments were 8 percent higher. Production by the six plants in the State was about 67 percent of capacity (70 percent in 1958). Stocks were considerably higher than at previous yearend. About 83 percent of the shipments terminated within the State; the remainder went to other Pacific Northwest States and Alaska.

Permanente Cement Co. announced plans early in the year for increasing output of its Bellingham plant, purchased in 1958 from The Olympic Portland Cement Co., Ltd. The quarry was to be enlarged, and new facilities for grinding clinker were to be added.

The Ideal Cement Co. began constructing a cement-distribution center at Vancouver, Clark County. When completed there were to be six 130-foot-high silos for bulk cement, a packaging plant, and facilities for loading cement into railroad cars. The company also indicated interest in building a new cement-production plant on the Snake River at Clarkston, Asotin County. The Lime Point quarry 30 miles upriver would furnish the limestone. The possibility of using barge transportation influenced selection of the site.

Combined production from nine cement plants operating in Washington and Oregon was 8,081,400 barrels (376 pounds per barrel) of finished portland cement; the same plants shipped 7,819,000 barrels during the year.

Clays.—The quantity of clays sold or used by producers in Washington decreased 7 percent, mostly because of reduced output of miscellaneous clay for heavy clay products.

King and Spokane Counties continued to be the principal sources of fire clay. Eleven pits in seven counties furnished clay for making heavy clay products, and clay for use at cement plants was dug in three counties. A small quantity of bentonite was used as a hydroseal.

Builders Brick Co. opened a new brick plant near Seattle, King County, in November. The plant had an annual capacity of 18 million standard-size brick. Seattle Brick & Tile Co. closed its clay-products plant in April to make way for a new highway.

Test work was conducted by W. Parkin on shale from a deposit near Tenino, Thurston County. It was planned to expand the shale for use as lightweight aggregate.

Diatomite.—Production of diatomite was 13 percent lower than in 1958. Kenite Corp., Quincy, Grant County, the only producer, marketed its product for filtration, filler, insulation, and miscellaneous purposes.

Gypsum.—Most of the gypsum mined was used for agricultural purposes. Output by Agro Minerals, Inc., Okanogan County, the only producer, was 50 percent higher.

Gypsum building products were made in Seattle by Kaiser Gypsum Co., Inc., from raw material mined in Baja California, Mexico. A company at Spokane marketed Canadian gypsum for agricultural use.

Magnesian Minerals.—Output of crude magnesite by Northwest Magnesite Co., Stevens County, was about 12 percent higher. This magnesite operation continued to be the largest in the Nation. Demand for refractory magnesia was heavy after settlement of the nationwide steel strike.

The amount of olivine shipped every year by Northwest Olivine Co., Skagit County, has increased steadily since 1955. Output, used mainly as foundry sand, was about 23 times greater than in 1955.

Pumice.—Output of pumice decreased in 1959 because small quantities were used in the construction of the Priest Rapids Dam. The Grimes Co. (formerly the Butte Pozzolan Co.) mined pumicite near Sunnyside, Yakima County. Casper Riste mined pumice for making concrete building block at the Sorlie pit, Chelan County, under lease from Arne Sorlie.

Sand and Gravel.—Production of sand and gravel dropped to 21.4 million tons ($18.6 million) in 1959 from 24.4 million tons ($20.0 million) in 1958. The decline was due partly to a slowdown in construction under the Federal highway program.

Production was reported from 36 of the 39 counties in the State. Six counties (Grant, King, Pierce, Snohomish, Spokane, and Walla Walla) each had output valued at more than $1 million. Distribution by use was roadbuilding and maintenance 56 percent, construction 36 percent, and miscellaneous 8 percent.

Stone.—The total quantity of stone quarried was 57 percent higher than 1958. Output was 12.3 million tons valued at $13.6 million. The three major consumers—U.S. Army Corps of Engineers, Washington State Highway Department, and U.S. Forest Service—contributed to the increase. Stone was quarried in 34 of the 39 counties in the State, and Adams and King Counties each reported production valued in excess of $1 million.

There was considerable interest in silica deposits in Washington during the year. Pacific Silica Co. began open-pit operations at Quartz Mountain near Spokane, and at a quarry near Okanogan.

Lane Mountain Silica Co., a joint effort of two established companies, was formed to develop a silica deposit near Chewelah, Stevens County.

Strontium Minerals.—Mineral Products Corp. processed and sold a small quantity of strontium minerals from stockpiled material for use by the chemical industry for purification purposes.

Talc and Soapstone.—Output of soapstone was about the same as in 1958. Two grinding plants processed much of the production from four sources in Skagit County. Soapstone mined in Washington was also sold to grinding plants in Oregon. The ground product was used principally as a filler in paint; a smaller quantity was sold for use as a carrier in insecticides.

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Sand and gravel	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Building	5,630	$5,626	5,366	$5,725
Road material	4,403	4,185	4,267	4,076
Railroad ballast	154	71	(1)	(1)
Other [2]	1,514	984	1,693	1,368
Total	11,702	10,866	11,325	11,170
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Building	2,721	2,916	2,264	2,556
Road material	9,967	6,304	7,771	4,850
Total	12,688	9,220	10,034	7,406
ALL OPERATIONS				
Building	8,351	8,542	7,629	8,282
Road material	14,370	10,489	12,037	8,926
Railroad ballast	154	71	(1)	(1)
Other [2]	1,514	984	1,693	1,368
Total [3]	24,389	20,086	21,360	18,576

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Includes molding and engine sands, and sand and gravel for ballast and miscellaneous unspecified purposes.
[3] Owing to rounding, individual items may not add to totals shown.

TABLE 5.—Stone sold or used by producers, by uses

(Thousand short tons and thousand dollars)

	1958		1959	
	Quantity	Value	Quantity	Value
Building (dimension stone)	(1)	(1)	(1)	(1)
Concrete, roadstone, and screening	5,720	$6,665	8,458	$8,600
Riprap	808	609	2,408	1,930
Railroad ballast	(1)	(1)	(1)	(1)
Other [2]	1,309	2,716	1,412	3,056
Total [3]	7,837	9,991	12,278	13,587

[1] Included with "Other" to avoid disclosing individual company confidential data.
[2] Used at cement, paper, metallurgical, and chemical plants; sugar refineries; and for miscellaneous unspecified purposes.
[3] Owing to rounding, individual items may not add to total shown.

Vermiculite (Exfoliated).—Vermiculite Northwest, Inc., Spokane, continued to expand vermiculite, mined in Montana, for use in insulation, lightweight concrete and plaster, and as a soil conditioner.

METALS

Aluminum.—Production of primary aluminum increased in early summer with reactivation of capacity idled previously by fluctuations in the market that continued from 1958. Output totaled 333,615 short tons, valued at $165.4 million, an increase of 6 percent in value over 1958. A downward adjustment of production in the last quarter was attributed to the effects of the steel strike on consumers that use both steel and aluminum.

The Bonneville Power Administration added stability to the regional industry when it announced that the $17.50-a-kilowatt-year power rate established in 1938 would not be increased, and assured aluminum producers power at the same cost until December 1964.

Moderate expansion of facilities in the State was planned by the aluminum companies. Adding holding furnaces, a pig-casting machine, and a storage building at Wenatchee by Aluminum Company of America (Alcoa) was to cost over $250,000. Disclosure of this planned expenditure was preceded by an earlier announcement by Alcoa that a $100,000 pig-casting machine was being installed at its Vancouver plant.

Superpurity aluminum capacity was increased by Kaiser Aluminum & Chemical Corp. at Mead, by the installation of two new refining cells. Production-line fabrication of assorted building panels in a cold-roll forming mill was initiated by the Kaiser firm at Trentwood.

TABLE 6.—Primary aluminum plant capacity and production data

Year	Rated primary capacity, short tons	Primary production			Average U.S. ingot price per pound, cents
		Short tons	Percent of national total	Value (thousands)	
1950-54 (average)	354,000	331,321	32	$124,752	19.8
1955	453,000	452,874	29	197,837	23.7
1956	481,000	486,204	29	233,632	26.0
1957	483,000	445,709	27	227,383	27.5
1958	483,000	311,417	20	156,376	26.9
1959	483,000	333,615	17	165,423	26.9

Copper.—Much of the mine production of 49 tons of recoverable copper (6 percent below 1958) was a byproduct from operations principally directed to recovering lead and zinc. Ore valued chiefly for its copper was mined only at the Kromona property in Snohomish County. Recoverable copper in lead-zinc ores from the Grandview and Pend Oreille mines comprised the remainder (57 percent) of the State total. Copper production in Washington dropped sharply after the Holden mine in Chelan County was closed in mid-1957.

Ferroalloys.—Operations at two of the three alloy plants in the State were adversely affected by a steel-industry strike during the last half of the year. Ohio Ferroalloys Corp., producer of ferrosilicon and silicon metal at Tacoma, stockpiled ferrosilicon as a result of low demand, and Pacific Northwest Alloys, Inc., Spokane, halted low-carbon ferrochromium production for a period. In contrast, Keokuk Electro-Metals Co. at Wenatchee, producing primarily silicon metal and a smaller quantity of ferrosilicon, operated at a high production level, largely because of increased demand for silicon metal by the aluminum industry.

Gold.—As in 1958, Lovitt Mining Co., Chelan County, and Knob Hill Mines, Inc., Ferry County, were the principal gold-producing companies in the State. Five other lode mines and one placer mine reported gold output; however, these provided less than 1 percent of the State total. Although operations of the Knob Hill and Lovitt companies were disrupted by two separate strikes at the Tacoma smelter during the year, gold output for the State increased.

The usual 25-man work force at the Lovitt Gold King mine was reduced to 7 during the first strike at Tacoma. Gold-silver ore, normally shipped directly to the smelter, was stockpiled at the mine during the smelter closure. The operation again was affected adversely by the second, more prolonged, strike.

Knob Hill Mines, Inc., diverted gold-silver concentrates in March from the struck Tacoma smelter to the American Smelting and Refin-

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1950-54 (average)	28	5	1,449	68,720	$2,405	330	$299
1955	16	1	1,712	74,360	2,603	436	395
1956	34	1	1,697	70,669	2,473	448	406
1957	19	1	1,495	(3)	(3)	(3)	(3)
1958	14	3	975	(3)	(3)	(3)	(3)
1959	15	1	958	(3)	(3)	(3)	(3)
1860-1959			(4)	[5] 2,844,331	[5] 78,307	[5] 16,391	[5] 12,333

Year	Copper		Lead		Zinc		Total value (thousands)
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)	
1950-54 (average)	4,176	$2,097	10,216	$2,992	21,638	$5,972	$13,765
1955	3,958	2,953	10,340	3,081	29,536	7,266	16,297
1956	2,926	2,487	11,657	3,660	25,609	7,017	16,044
1957	1,700	1,023	12,734	3,642	24,000	5,568	13,766
1958	52	27	9,020	2,111	18,797	3,835	10,469
1959	49	30	10,310	2,371	17,111	3,936	10,986
1860-1959	122,000	43,182	200,000	46,105	398,000	89,223	281,828

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped to smelters during calendar year indicated. Owing to rounding, figures may not add to totals.

[2] Does not include gravel washed.

[3] Figure withheld to avoid disclosing individual company confidential data.

[4] 1860-1903—figure not available; 1904-59—29,269,000 short tons.

[5] Excludes 1957-59.

ing Co. at Selby, Calif., until the Selby smelter was also closed by strike in August. Plans were initiated in the last months of the year to ship concentrates to the Consolidated Mining & Smelting Co. facilities at Trail, British Columbia. Bullion, in turn, was to be shipped from Trail to the Denver (Colo.) Mint. Cyanide precipitates, a second product of the Knob Hill mine operation, were shipped to Wildberg Bros. Smelting & Refining Co., South San Francisco, Calif., for recovery of gold and silver.

Iron Ore.—The Kulzer mine, Stevens County, the only mine producing iron ore for commercial use, shipped over 4,000 long tons for consumption at a local cement plant. About a ton of ore was shipped from the Buckhorn mine, Okanogan County, for metallurgical testing. Several Japanese companies showed interest in the Buckhorn mine during the year.

The State of Washington, through contract let by the State Department of Conservation and Development, began a $40,000 aerial magnetometer survey in northeastern Okanogan and northwestern Ferry Counties to seek possible magnetic-iron anomalies. The survey was recommended in a report of an advisory group (Industrial Raw Materials Advisory Committee) to the Director of the Washington Department of Commerce and Economic Development and was part of an investigative program aimed at determining the feasibility of establishing an iron-smelting industry in the State.

Lead.—Lead output was 14 percent above that in 1958. Two mines in the northeastern part of the State (American Zinc, Lead & Smelting Co. Grandview mine and Pend Oreille Mines & Metals Co. Pend Oreille mine) yielded over 99 percent of the total lead production.

Hearings were held before the Federal Power Commission about construction of dams in the Metaline mining district, Pend Oreille County. Owners of mining interests in the district were opposed to the project on the grounds that current and future mining operations could be flooded.

Manganese.—An 83-ton shipment of 42-percent manganese ore was made by the Inland Empire Mining Co., Clallam County. The ore, mined from properties southwest of Port Angeles, was sold to the Fed-

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1959, by classes of ore or other source material, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	4	99,387	(1)	(1)	----------	----------	----------
Dry gold-silver and dry silver [2]	4	138	(1)	(1)	----------	500	6,100
Copper	1	1,500	(1)	(1)	42,000	----------	----------
Lead	3	114	----------	(1)	----------	40,000	3,600
Lead-zinc and zinc [2]	3	856,471	----------	(1)	56,000	20,579,500	34,212,300
Total "lode" material	15	957,610	(1)	(1)	98,000	20,620,000	34,222,000
Gravel (placer operations)	1	(1)	(1)	----------	----------	----------	----------
Total	16	957,610	(1)	(1)	98,000	20,620,000	34,222,000

[1] Figures withheld to avoid disclosing individual company confidential data.
[2] Combined to avoid disclosing individual company confidential data.

eral Government under the carlot stockpiling program. This program was terminated during the year after its tonnage quota was reached.

Silver.—Output of silver came largely from the Knob Hill and Gold Dollar properties in Ferry County. The Gold King mine in Chelan County and the Pend Oreille mine in Pend Oreille County contributed considerably smaller but still substantial quantities. Lead-zinc producers in the State recovered silver at the average ratio of 3.6 ounces of silver per ton of lead produced, slightly lower than the 3.8:1 silver-lead ratio in 1958.

Steel.—Steel output at Bethlehem Steel Co., Pacific Coast Division, and Northwest Steel Rolling Mills, both at Seattle, reached near capacity during the first half of the year. Production was halted for most of the second half by a nationwide steel strike.

The Bethlehem company continued an extensive expansion program. Two new 100-ton-capacity electric-arc furnaces and a highly automated rolling mill were in operation. A new office building and landscaping remained to be completed in the multimillion-dollar improvement program.

Uranium.—Little change was apparent in uranium mining activity in the northeastern section of the State; ore production increased only slightly. There was some indication that producers were awaiting the results of contract negotiations between Dawn Mining Co. and the Atomic Energy Commission (AEC), covering concentrate purchases for 1962–66, since the contract would indicate the future of the ore market.

The Dawn uranium mill at Ford treated company and custom ores throughout the year. Under an AEC contract, the maximum tonnage of 160,000 tons of ore was treated. Minimum acceptable ore tonnage was reduced from 350 to 300 dry tons. About 130,000 tons of ore was mined from the Dawn Mining Co. Midnite mine, near Ford, by Isbell Construction Co., Reno, Nev., and hauled to the mill by Vic-Ore, Inc., Spokane subsidiary of Consolidated Freightways. A 3-year contract held by the latter two companies expired with the usual cessation of mining in October because of weather conditions.

Several companies with properties in the Mount Spokane area made ore shipments. Daybreak Uranium, Inc., installed a simple concentrating plant at the Dahl lease to attempt upgrading ore below the 0.16-percent uranium oxide requirement at the Ford mill.

Zinc.—Recoverable zinc, obtained from ores mined in northeastern Washington, was 9 percent below 1958. The value of production, however, was 3 percent greater because of the higher average price for zinc during the year. The Grandview and Pend Oreille mines, Pend Oreille County, were the only principal producers.

MINERAL FUELS

Carbon Dioxide.—Recovery of carbon dioxide from mineral waters in Klickitat County was at a reduced rate, compared with 1958. The gas was converted to dry ice by Gas-Ice Corp.

Coal.—Thirteen mines in four counties accounted for a total output of 242,000 tons, 10,000 tons less than in 1958. Two new underground mines were opened during the year—Rogers mine (Palmer Coking Coal Co., Inc.) and Stoker No. 3 (Stoker Coal Mining Co.). The Stoker No. 3, which began operating early in September, burned out in December and was closed permanently.

Peat.—Production of peat from three counties in the State totaled a little less than in 1958. King and Snohomish Counties, the major producing areas, had almost the same amount of production.

Petroleum and Natural Gas.—Recovery of crude oil from the Sunshine Mining Co. Medina No. 1 well, Ocean City, Grays Harbor County, was much lower than in 1958.

There was considerable interest in petroleum possibilities in the State, and exploratory efforts included drilling and plans to drill by several companies. Sunshine Mining Co. brought in a gas discovery well at Ocean City, Grays Harbor County, but the well was capped because of a lack of pipeline facilities to markets. Tideland Oil & Gas Corp. carried out a drilling program on acreage leased from the Sunshine company. Shell Oil Co. drilled three dry test wells near Toledo, Lewis County. Washington-California Exploration Co. decided to deepen its well in the Copalis Beach area of Grays Harbor County.

Union Oil Company of California purchased 1,100 acres on the Tulalip Indian Reservation, Snohomish County, for a refinery site. Richfield Oil Co. and Standard Oil Company of California held acreage in this locality. Pacific Supply Cooperative completed construction of a tank farm in the Lake Vancouver area and obtained a permit to build a refinery at the site. U.S. Oil & Refining Co. began operating its million-dollar asphalt plant at Tacoma early in the year.

TABLE 9.—Test holes drilled for oil and gas in 1959 [1]

Company	Well	Total depth	County
Russell Cobb, Jr.	Merrill Ring No. 1	8,519	Clallam.
Adams-Benedict Oil Co., Inc.	Benedict No. 1	2,600	Clark.
Sunshine Mining Co.	Sampson John No. 1	4,522	Grays Harbor.
Tideland Oil & Gas Corp.	Carlisle Estate No. 1	3,596	Do.
Shell Oil Co.	Sturdevant No. 1	8,446	Lewis.
Do.	Zion No. 1	6,560	Do.
Do.	Thompson No. 1	10,820	Do.

[1] Washington Division of Mines and Geology.

REVIEW BY COUNTIES

Chelan.—Limestone from a quarry near Leavenworth was shipped to the Ideal Cement Co. plant at Grotto, King County. Pumice was mined and processed near Entiat for manufacturing lightweight-concrete aggregate.

Substantially increased quantities of gold and silver recovered from a smaller tonnage of ore were reported for the Lovitt Mining Co. Gold King mine in 1959, compared with production in 1958. Most of the ore was shipped to the Tacoma copper smelter, but some was sold to the Trail (British Columbia) smelter while the Tacoma works was closed by strike.

Aluminum Company of America announced a $250,000 expansion program for its Wenatchee plant. New equipment was to include hot-metal holding furnaces and a pig-casting machine.

Clallam.—One shipment of manganese ore was made by Inland Empire Mining Co. from properties southwest of Port Angeles. The ore was sold to the General Services Administration (GSA) for stockpiling.

Clark.—Elmer C. Muffett Brick & Tile Factory and Hidden Brick Co. produced building brick and draintile from clay produced at pits near Ridgefield and Vancouver, respectively. Output remained about the same as in 1958.

A $100,000 pig-casting machine for making 50-pound aluminum pig was installed at the Vancouver aluminum-reduction plant by Aluminum Company of America. The unit gives more uniform size, quality, and appearance than was possible by the former hand-pouring method. One of two idle potlines at the Vancouver works was re-

TABLE 10.—Value of mineral production in Washington, by counties[1]

(Thousand dollars)

County	1958	1959	Minerals produced in 1959 in order of value
Adams	$594	$1,239	Stone, sand and gravel.
Asotin	42	(2)	Sand and gravel.
Benton	344	256	Sand and gravel, stone.
Chelan	1,250	1,749	Gold, stone, sand and gravel, silver, pumice.
Clallam	516	109	Sand and gravel, manganese.
Clark	382	890	Stone, sand and gravel, clays.
Columbia	(2)	----------	
Cowlitz	385	420	Stone, sand and gravel.
Douglas	1,030	685	Sand and gravel, stone.
Ferry	(2)	(2)	Gold, silver, sand and gravel, stone.
Franklin	717	1,131	Stone, sand and gravel.
Garfield	62	52	Stone.
Grant	4,132	1,682	Sand and gravel, diatomite, stone.
Grays Harbor	258	288	Sand and gravel, stone, petroleum.
Island	114	236	Sand and gravel, stone.
Jefferson	258	318	Stone, sand and gravel.
King	8,864	10,000	Cement, sand and gravel, stone, coal, clays, peat.
Kitsap	176	232	Sand and gravel, stone.
Kittitas	1,416	1,214	Coal, sand and gravel, stone, gold, silver.
Klickitat	345	1,692	Sand and gravel, stone, carbon dioxide.
Lewis	475	668	Sand and gravel, stone, coal, clays.
Lincoln	603	230	Sand and gravel, stone.
Mason	(2)	(2)	Do.
Okanogan	138	506	Sand and gravel, stone, gypsum, silver, gold, iron ore.
Pacific	315	204	Stone, sand and gravel.
Pend Oreille	(2)	(2)	Zinc, lead, cement, stone, sand and gravel, silver, copper, uranium, gold.
Pierce	3,042	3,012	Sand and gravel, stone, clays.
San Juan	----------	120	Sand and gravel.
Skagit	3,486	3,539	Cement, sand and gravel, stone, olivine, talc and soapstone, strontium, chromite.
Skamania	257	703	Stone, sand and gravel.
Snohomish	1,540	1,828	Sand and gravel, stone, peat, clays, copper, gold, silver.
Spokane	4,715	4,980	Cement, sand and gravel, stone, clays, uranium.
Stevens	3,357	3,391	Uranium, magnesite, stone, sand and gravel, iron ore, lead, barite, clays, silver, zinc, grinding pebbles.
Thurston	204	588	Sand and gravel, stone, coal, peat.
Walla Walla	1,483	1,547	Sand and gravel, stone.
Whatcom	(2)	(2)	Cement, stone, sand and gravel, clays.
Whitman	398	496	Stone, sand and gravel.
Yakima	1,158	964	Sand and gravel, stone, pumice, clays.
Undistributed[3]	20,486	20,861	
Total[4]	60,896	63,894	

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[1] No production reported in Wahkiakum County.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Includes value of sand and gravel, stone, and gem stones that cannot be assigned to specific counties and value of minerals for counties indicated by footnote 2.

[4] Adjusted to eliminate duplicating value of clays and stone; 1958 total revised.

activated in May as market conditions continued to improve, a trend that began late in 1958.

Cowlitz.—Production of aluminum metal was continued throughout the year at the Reynolds Metals Co. reduction plant at Longview.

Douglas.—Silicon metal and some ferrosilicon was produced in electric furnaces at the Keokuk Electro-Metals Co. plant near Wenatchee.

Ferry.—Knob Hill Mines, Inc., operating its Knob Hill gold mine and the adjacent Gold Dollar mine that it leases from Day Mines, Inc., continued, by far, to be the largest source of gold and silver in the State. According to Day Mines, Inc., annual report to shareholders, 42,006 tons of high-grade gold-silver ore from the Gold Dollar was milled during the year.

Grant.—Diatomite was mined and processed at an operation near Quincy. There was a sharp decrease in the quantity of sand and gravel produced in the county because of lessened demand by the U.S. Army Corps of Engineers and the Grant County PUD (Priest Rapids Dam).

King.—King County again was the principal nonmetal-producing area in the State. Value of output topped the 1958 value by more than $1 million. Increases were recorded in value of cement, clays, coal, and stone output. Sand and gravel and peat values were lower. The county led in cement and stone production, and ranked second in output of clays, peat, and sand and gravel.

Five coal mines yielded about 10 percent more coal than in 1958. The Franklin No. 12 and Danville mines (Palmer Coking Coal Co., Inc.) and the Newcastle mine (B & R Coal Co.) were the principal sources.

The Ideal Cement Co. Grotto plant operated at an increased rate during 1959. Clay for use at the plant was dug at a company pit. Manufacturers of firebrick and tile, heavy clay products, and flowerpots also used locally mined clay.

Corporate structure changes were reflected in the new name for Bethlehem Steel Co., Pacific Coast Division (formerly Bethlehem Pacific Coast Steel Corp.), and the firm also completed a 2-year, multimillion-dollar modernization and expansion program at its facilities in Seattle. Two 100-ton electric furnaces replaced the former open-hearth furnaces and raised capacity by 70 percent; soaking pits, a 32-inch blooming mill, a 12-inch merchant bar mill, and a baghouse for smoke abatement were other new facilities added.

Kittitas.—The county again was the leading source of coal in the State, although output dropped about 18,000 tons. The strip and underground mines of Northern Pacific Railway Co. Coal Department at Roslyn and the No. 4 mine of Roslyn Cascade Coal Co. were active. Sand and gravel and stone also were produced.

Okanogan.—Gypsum was mined at the Poison Lake deposit (near Tonasket) by Agro Minerals, Inc. The company epsomite operation at the same location was idle.

Pend Oreille.—The principal nonmetal mineral industry in the county continued to be the Metaline Falls plant of the Lehigh Portland Cement Co. Output of portland and masonry cement was lower than in 1958. Total value of the output of nonmetals in the county was less than the previous year.

Lead-zinc ore production at the Pend Oreille mine (Pend Oreille Mines & Metals Co.) continued to be curtailed, according to the company annual shareholder report. However, the mine was the source of nearly 75 percent of the State total lead output and over 60 percent for zinc. The tonnage of ore mined and milled at the property increased to 619,779 tons (607,695 in 1958). Operating costs increased only slightly to $3.116 a ton, compared with $3.037 the previous year, despite an increase of $0.212 a ton for development. The firm completed 6,679 feet of drifts and raises, and 23,334 feet of diamond and longhole percussion drilling.

Recoverable lead and zinc in ore from the Grandview mine (American Zinc, Lead & Smelting Co.) comprised much of the remainder of the State output of these metals. The company reported operations at capacity during the year, and 14,692 tons of combined zinc-lead concentrates were produced; this was somewhat lower than for 1958, although the tonnage of ore treated was greater. Mechanized-mining equipment installed in October 1958 increased efficiency and lowered mining costs, according to the company. Operation with the equipment, an improved version of a self-loading ore carrier called the "Gismo" and first used in the Grandview mine, was described in an article.[3]

Utahcan Mines, Inc., began producing lead-zinc ore at its new open-pit mine near Ione. The firm completed construction of a 150-ton mill during the summer.

Pierce.—The county maintained a $3 million valuation and gained fifth place in the State for output of nonmetal commodities. Sand and gravel production was highest in the State despite a decline, compared with 1958. The quantity of stone quarried increased, but clay output dropped for the second year.

Skagit.—Output value of nonmetal commodities was slightly higher than in 1958; the county was fourth in the State. Increases in the value of cement, olivine, soapstone, and stone output more than offset a decrease in the value of sand and gravel.

Snohomish.—Nonmetal mineral commodities produced in the county were valued at $1.8 million, compared with $1.5 million in 1958. Sand and gravel and stone were used for Federal, State, county, and municipal road construction.

Spokane.—Production valued at $5 million put Spokane County third in the State as a source of nonmetal commodities. In terms of value, the county rated first for clay and third for cement, sand and gravel, and stone. The Irvin plant of Ideal Cement Co. continued to be the principal nonmetal mineral industry in the county. Clay and limestone mined locally and iron ore from Stevens County were used at the plant. Refractories and other formed-clay products were made at Mica by Gladding, McBean & Co. Gravel and stone for road construction and maintenance were used by the State and county road departments and the U.S. Army Corps of Engineers. Imported gypsum was marketed by Greenacres Gypsum Co. (formerly Columbia Gypsum Co., Ltd.).

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[3] Calhoun, William M., Transloader Mining at the Grandview Mine of American Zinc, Lead & Smelting Co., Metaline Falls, Washington: Canadian Min. Jour., vol. 80, No. 1. January 1959, pp. 61–64.

Kaiser Aluminum & Chemical Corp. adjusted the output of its aluminum-reduction plant at Mead to meet varying market conditions. One of the eight potlines at the smelter remained closed throughout the year, and two others were closed for varying periods. At the company's aluminum-fabricating works at Trentwood, new rolling equipment was installed for use in making building panels.

Ferrochromium production continued at the Pacific Northwest Alloys, Inc., plant, also at Mead. Chromium ore imported from Rhodesia, south Africa, was the basic raw material.

Uranium ore was shipped from four properties in the county. The Herem Moore lease of Bear Creek Uranium Exploration Co. at Bear Creek was the largest source, followed by the Dahl lease of Daybreak Uranium, Inc. The ore was shipped to the Dawn Mining Co. mill at Ford, Stevens County.

Stevens.—Mining and processing of crude magnesite was the major nonmetal mineral industry in the county. Output value of this commodity was surpassed only by uranium production. Magnesite was mined at the Red Marble quarry by Northwest Magnesite Co. The mine and plant were inactive for about 3 months because of the nationwide steel strike, which reduced the demand for refractory magnesia.

Two mines in the county were the source of 99 percent of the State uranium ore output. The Dawn Mining Co. Midnite mine was by far the largest producer. A considerable tonnage also was obtained from the Peters lease by Silver Buckle Mining Co. Ore from the mines was shipped to the Dawn company uranium mill at Ford for processing.

Ore-grade requirements for the Ford mill were lowered beginning May 1 for the remainder of the year. Minimum acceptable ore grade was reduced from 0.20 percent uranium oxide to 0.16 percent. The minimum acceptable tonnage of custom ore receipts at the mill also was lowered from 350 dry tons to 300 tons. Ore purchases at the mill were made through separate contracts with individual producers.

Whatcom.—Value of output of cement, stone, sand and gravel, and clays ranked the county second in the State for production of nonmetal commodities. The Olympic Portland Cement Co., Ltd., plant continued to be the principal mineral industry in the county; this operation had the highest cement output in the State.

Yakima.—Completion of major construction at the Priest Rapids Dam resulted in sharply decreased pumicite production for use as pozzolanic material. Bentonite was mined in small quantity from the Tietonite pit near Yakima by Calco Industrial Minerals.

The Mineral Industry of West Virginia

This chapter has been prepared under the cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines. U.S. Department of the Interior, and the West Virginia Geologic and Economic Survey.

By James R. Kerr [1] and Jean Pendleton [2]

MINERAL production in West Virginia in 1959 declined 2 percent in value despite relatively stable output of most minerals. The drop in value was due primarily to decreased value of coal production. Although output of coal increased slightly, the value dropped $14 million as more efficient mining methods and cost-cutting practices lowered the average value 13 cents per ton, to $5.19.

Industries allied with steel prospered during the first half of the year, but the advent of the steel strike at mid-year cut orders and lowered overall production. Sand and gravel production decreased 8 percent as the road-construction outlet for production was depressed. Increased demand for chlorine, the chief end product of salt, caused significantly increased salt output.

Counties leading in mineral production were McDowell, Logan, Wyoming, Marion, Kanawha, Raleigh, and Monongalia.

TABLE 1.—Mineral production in West Virginia [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays	509,806	$1,960	595,724	$2,492
Coal	119,467,697	635,201	119,692,129	621,003
Natural gas million cubic feet	204,581	50,734	[2] 215,000	[2] 53,500
Natural gas liquids:				
Natural gasoline thousand gallons	27,917	5,643	29,242	1,808
LP-gases do	235,524	12,806	308,316	15,534
Petroleum (crude) thousand 42-gallon barrels	2,186	7,629	[2] 2,177	[2] 7,837
Salt (common)	626,709	2,784	810,914	3,305
Sand and gravel	5,252,586	11,729	4,854,052	10,513
Stone [3]	5,598,623	9,990	5,922,993	10,482
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, cement, gem stones, and lime		13,067		13,319
Total West Virginia [4]		[5] 749,747		737,886

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Preliminary figure.
[3] Excludes certain stone, data for which are included with "Items that cannot be disclosed."
[4] Total adjusted to avoid duplicating value of clays and stone used in cement and lime.
[5] Revised figure.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Coal production remained at virtually the same rate as in 1958. Increased output for the metallurgical market during the early months of the year was partially offset by declined production later in the year because of a lengthy steel strike. The European coal market did not improve, as stocks on hand at European consumers remained at high levels. The domestic utility market however, remained steady, consuming large tonnages of coal in 1959.

As in past years, underground mining was the leading method, comprising 91 percent of the total. Strip mining comprised 6 percent, and auger mining 3 percent. Although production increased slightly, the number of active mines decreased by 71, indicating that marginal high-cost operations were being closed. The average value of coal production decreased by $0.13 to $5.19 per ton, a further indication of the effect of cost-cutting practices. The number of active mines totaled 1,464, of which 1,237 were underground, 147 strip, and 80 auger.

The percent of production mined by continuous-mining machines increased 7 percent, to 26 percent. The number of machines in operation increased from 189 to 260, accentuating the adoption by more companies of modern, efficient mining systems.

Underground mining was highly mechanized, with 92 percent of the output loaded mechanically. Mobile loading was the most important method, comprising 71 percent of mechanically loaded output. Of the 1,183 mobile loading machines used, 114 loaded into mine cars, 191 onto conveyors, and 878 into shuttle cars. Mobile loading into mine cars, the oldest and most costly method, decreased by 27 machines.

Hand-loaded conveyors in use dropped by 136, and they handled less tonnage than in 1958.

Other mining equipment used at underground mines included 2,058 cutting machines, 2,396 handheld and postmounted coal drills, 137 mobile coal drills, and 571 rotary and 428 percussion roof, or rock drills.

The following equipment was used at strip mines: 297 power shovels, 17 draglines, 11 carryall scrapers, 262 bulldozers, 82 horizontals and 64 vertical overburden drills, and 529 trucks averaging 14 tons' capacity. The trucks traveled an average of 7 miles form pit to tipple. There were 95 augers, 20 power shovels, 1 scraper, 78 bulldozers, and 4 horizontal and 4 vertical overburden drills used at auger mines. A total of 213 trucks, averaging 14 tons in capacity, traveled an average of 6 miles from pit to tipple.

Mechanical cleaning increased 3 percent in terms of total tonnage cleaned. Nine fewer plants (183) were active. Of the total tonnage cleaned, jigs cleaned 34 percent, wet washing other than jigs 56 percent, and pneumatic methods 10 percent. Crushing of coal increased 5 percent and comprised 28 percent of total output. Of the 14 percent treated for antifreezing and dust-allaying purposes, 84 percent was treated with oil and the balance mostly by combinations of calcium chloride and oil. This year 95 percent of the coal mined in West Virginia was shipped by rail or barge, 3 percent by truck, and 2 percent by other means.

According to preliminary data, the State coal-mining industry recorded 86 fatal and 4,800 nonfatal injuries during the year, compared with 149 fatal and 5,190 nonfatal injuries in 1958. Commendable reduction was noted, not only in the total number of injuries, but in their frequency and severity. Fatalities per million tons of coal mined were 0.73, compared with 1.26 in 1958. The frequency rate decreased to 56.46 injuries per million man-hours and 40.68 injuries per million tons mined from 61.41 and 43.80, respectively. Comparative employment data showed that the average number of men active decreased to 54,800 from 58,000. The average number of days worked per man, increased to 196.9 from 185.7. The total man-hours worked increased to 85 million, compared with 84.5 million in 1958.

TABLE 2.—Coal production by counties, in short tons

County	1958		1959	
	Production	Value	Production	Value
Barbour	3,221,003	$14,542,104	3,097,083	$13,412,690
Boone	5,456,235	26,379,072	6,306,774	29,891,948
Braxton	196,788	814,734	131,870	555,012
Brooke	748,411	3,577,772	370,812	2,069,577
Fayette	5,153,074	30,991,144	4,809,004	25,178,142
Gilmer	407,372	1,557,298	422,372	1,537,024
Grant	94,179	278,689	75,145	244,517
Greenbrier	1,084,539	5,147,430	670,812	3,036,446
Harrison	6,538,502	29,355,409	6,537,795	28,635,986
Kanawha	9,583,862	45,191,208	9,393,360	45,064,241
Lewis	790,197	2,668,994	954,300	3,239,225
Logan	16,449,686	79,212,992	16,680,806	78,698,697
Marion	9,471,631	53,237,029	9,347,547	50,430,723
Mason	346,397	1,156,802	496,934	1,606,429
McDowell	13,955,106	95,777,325	13,522,354	92,179,969
Mercer	888,508	5,295,652	799,189	4,199,231
Mineral	97,546	372,053	48,853	205,404
Mingo	5,905,108	29,606,338	6,555,801	32,036,918
Monongalia	6,945,673	34,982,616	7,276,577	37,147,396
Nicholas	4,726,596	23,935,660	4,801,953	23,851,926
Pocahontas	576,448	2,792,342	451,539	1,842,127
Preston	2,039,176	7,465,539	2,307.605	8,222,983
Putnam	67,493	232,518	66,455	297,599
Raleigh	7,777,600	48,219,343	6,518,471	39,897,372
Randolph	874,073	4,730,843	913,825	4,737,786
Summers	11,519	49,383	----------	----------
Taylor	174,648	588,399	75,307	273,985
Tucker	406,808	1,132,032	145,861	414,671
Upshur	1,085,414	4,770,190	1,083,175	4,769,372
Wayne	56,337	192,109	72,860	279,718
Webster	769,224	4,407,116	430,899	2,475,556
Wyoming	10,344,308	61,681,966	10,886,119	64,030,924
Undistributed [1]	3,224,236	14,859,316	4,440,672	20,539,667
Total	119,467,697	635,201,417	119,692,129	621,003,261

[1] Includes data for Clay, Marshall, and Ohio Counties for 1958 and 1959.

Of the 86 fatalities, 80 occurred underground, 5 in surface operations affiliated with underground, and 1 in a strip mine. Fifty-two were caused by falls of roof, 21 by haulage, 7 by machinery, 1 by electricity, 1 by gas or dust explosion, 1 by fall of face, and 3 by other circumstances.

The No. 14 mine of United States Steel Corp. at Gary, McDowell County, operated 693,817 man-hours without a disabling injury and

TABLE 3.—Coal production in West Virginia

(Thousand short tons and thousand dollars)

Year	Quantity	Value	Year	Quantity	Value
1950–54 (average)	139,848	$716,930	1957	156,842	$875,587
1955	139,168	653,388	1958	119,468	635,201
1956	155,890	824,043	1959	119,692	621,003

was awarded the Sentinels of Safety trophy as winner in the bituminous-coal-mine (underground) class.

Coke and Coal Chemicals.—Four oven-coke plants (742 ovens) were active, 1 less plant and 71 less ovens than in 1958. E. I. du Pont de Nemours & Co. closed its Belle plant permanently during the year. Production of oven coke was 3,077,138 tons at an average value of $16.56 per ton. A total of 4,451,915 tons of coal was carbonized to produce coke at an average yield of 69.12 percent. Recovered products at the oven-coke plants included 216,485 tons of coke breeze, 50,036,155 thousand cubic feet of coke-oven gas, 43,440 tons of ammonium sulfate equivalent, 44,953,339 gallons of coke-oven tar, and 12,421,578 gallons of crude light oil, from which were derived 7,501,918 gallons of benzene, 2,228,793 gallons of toluene, 727,721 gallons of xylene, and 136,397 gallons of solvent naphtha (crude and refined).

Pennsylvania supplied the major portion of the coking-quality coal to the West Virginia oven-coke plants, the majority of which was high-volatile bituminous. Almost all coke produced was consumed by the producing companies in blast-furnace operations.

Preliminary data indicated 1,063 persons were employed in the coke industry (excluding officeworkers) working 2,424,869 man-hours. There were nine nonfatal injuries.

Petroleum and Natural Gas.—Natural-gas production increased 5 percent and natural-gas-liquid output was up 28 percent, chiefly due to a 31-percent increase in LP-gas production. Petroleum output decreased slightly but the total value increased because of the increased price per barrel.

The number of completed wells increased by 50, to 806; 29 were wildcat wells. Wildcat drilling was successful, as 23 became gas producers and only 6 were dry. Of the development wells completed, 93 were oil, 527 gas, 118 dry, and 39 service. Of all completed wells, 725 were drilled by cable-tool rigs and 81 by rotary rigs. Total footage drilled was 2,060,778 feet; average depth per well was 2,557 feet, compared with 2,704 feet in 1958. There were 14,325 producing oil wells, with a daily average output of 0.4 barrels per well. Ritchie County led with 141 well completions, followed by Calhoun with 99, and Wayne with 92. Significant drilling activity also was reported in Lewis, Gilmer, and Mingo Counties.[3] West Virginia's largest natural-gas well in history was completed the first week in September in the Weir sand formation, at a depth of 2,100 feet. Capacity of the well was 40,700,000 cubic feet daily. The well location is in the Point Creek gasfield in the Cabin Creek District, Kanawha County, about 30 miles southeast of Charleston.

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[3] Oil and Gas Journal, Review-Forecast: Vol. 58, No. 4, Jan. 25, 1960.

According to the American Petroleum Institute and the American Gas Association, reserves as of January 1, 1960, were 1,593,551 million cubic feet of natural gas; 51,259,000 barrels of petroleum, and 34,166,000 gallons of natural-gas liquids.

NONMETALS

Cement.—Alpha Portland Cement Co. did not operate in 1959, having permanently closed its Manheim plant in Preston County. Cement production decreased only slightly (2 percent), and increased production at Standard Lime and Cement Co., Division of American-Marietta Co., offset the loss in production, of over 500,000 barrels of cement, formerly supplied by the idle plant.

Shipments were mostly non-air-entrained general-use and moderate-heat portland cements shipped in bulk by rail to Maryland, Virginia, and the District of Columbia.

Clays.—Total production of clays increased 17 percent, as outputs of both fire and miscellaneous clay were greater than in 1958. Fire-clay production increased most, because demand for refractories, particularly firebrick and block, was 24 percent greater than in 1958. Heavy production of fire clay early in the year for consumption in the steel industry slackened later in the year as steel companies stopped all orders. Output of fire clay for building brick increased, as did miscellaneous clay output, which was used primarily for building brick. In addition, miscellaneous clay was used as an ingredient in manufacturing portland cement.

Fire clay was produced at four underground mines and one open-pit mine in Hancock and Kanawha Counties. Miscellaneous clay was mined at six open-pit mines in Berkeley, Cabell, Lewis, and Mercer Counties.

TABLE 4.—Clays sold or used by producers

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1950–54 (average)	526, 170	$1, 623, 343	337, 177	$308, 775	863, 347	$1, 932, 118
1955	406, 025	2, 277, 163	301, 408	286, 126	707, 433	2, 563, 289
1956	428, 033	2, 171, 942	341, 485	277, 266	769, 518	2, 449, 208
1957	402, 581	2, 445, 427	304, 952	245, 182	707, 533	2, 690, 609
1958	264, 107	1, 732, 634	245, 699	227, 340	509, 806	1, 959, 974
1959	328, 792	2, 178, 974	266, 932	312, 970	595, 724	2, 491, 944

Gem Stones.—Miscellaneous gem material was collected by hobbyists at scattered locations throughout the State.

Lime.—As for all industries allied with steel, higher demand and rates of production early in the year were offset by the steel strike later in the year. However, overall lime production increased 13 percent.

Almost three-fourths of the lime was dead-burned dolomite for refractory material. Most of the balance was for metallurgical uses, as additions to open-hearth and electric steel furnaces. Output was reported from Jefferson and Berkley Counties.

Natural Salines.—Calcium-magnesium-chloride, bromine, ethylene dibromide, and other bromine compounds were recovered from natural brine wells near South Charleston in Kanawha County. Production was 34 percent less than in 1958, as a strike closed the plant in mid-June.

Salt.—Production of salt increased 29 percent, as demand for chlorine increased. Three companies, two with wells in Marshall County, and one in Kanawha County, produced and consumed well brines chiefly for chlorine. One company in Mason County produced a small tonnage of evaporated salt for shipment chiefly to feed dealers in Kentucky, Ohio, and West Virginia.

Sand and Gravel.—Decreased activity in highway construction, reflected by decreased production of paving sand and gravel, offset increased demand for structural material and caused an 8-percent drop in sand and gravel production. Structural sand and gravel increased 44 and 40 percent, respectively, to comprise 55 percent of the total sand and gravel produced. Paving uses declined to 16 percent of the total, compared with 34 percent in 1958. Large tonnages of glass sand also were produced.

TABLE 5.—Sand and gravel sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Sand:				
Building	936, 348	$1, 216, 678	1, 348, 426	$1, 639, 914
Paving	1, 028, 377	1, 184, 291	273, 583	474, 545
Grinding and polishing	59	186	------	------
Fire or furnace	43, 095	63, 457	44, 813	64, 104
Engine	111, 385	288, 347	98, 143	278, 061
Gravel:				
Building	957, 112	1, 218, 645	1, 339, 069	1, 506, 153
Paving	769, 286	951, 741	482, 507	945, 462
Undistributed [1]	1, 406, 924	6, 805, 822	1, 267, 511	5, 604, 812
Total	5, 252, 586	11, 729, 167	4, 854, 052	10, 513, 051

[1] Includes blast (1959), glass, molding, ground, and other sands, railroad-ballast gravel, and other gravel.

There were 26 operations in 15 counties, of which 13 were stationary plants, 8 were dredges, and 5 were portable plants. Largest producing counties, in order of decreasing output, were Hancock, Morgan, Wood, Wetzel, and Ohio. Morgan County led in the value of production, because of its valuable glass and ground sand.

According to preliminary data, the industry employed 588 persons (553 production, 35 office) who worked a total of 1,258,919 man-hours.

Stone.—Apparent stone production increased 6 percent, as increased coverage of the sandstone industry resulted in the reporting of more than five times the 1958 sandstone-production figure. This increase offset slightly decreased limestone output. However, limestone dominated overall stone production, comprising over 90 percent of the total output. Chief uses of limestone were for iron and steel metallurgical fluxing, concrete and roadstone, and as an ingredient in cement and lime. Crushed sandstone production was entirely for concrete aggregate and roadstone. A small tonnage of calcareous marl was produced for soil conditioning.

Berkeley and Jefferson Counties led in production of limestone. Barbour, Monongalia, and Lewis Counties led in sandstone output.

TABLE 6.—Stone sold or used by producers, by uses

Use	1958		1959	
	Short tons	Value	Short tons	Value
Crushed and broken stone:				
Flux	2,403,790	$4,346,862	2,091,241	$3,926,152
Concrete and roadstone	1,717,434	3,053,291	2,327,733	3,951,001
Railroad ballast	(1)	(1)	115,959	177,315
Other [2]	210,274	487,845	227,495	493,162
Undistributed [3]	1,266,645	2,089,927	1,160,565	1,934,229
Dimension stone: Rough architectural (sandstone)	480	12,000	(1)	(1)
Total	5,598,623	9,989,925	5,922,993	10,481,859

[1] Figure withheld to avoid disclosing individual company confidential data.

[2] Includes limestone for miscellaneous uses (asphalt filler, rock dust (1958), masonry mortar (1959), and coal dust, stone sand and chemical) and calcareous marl (1958).

[3] Includes limestone used for cement and lime, riprap, agriculture, and railroad ballast (1958).

The stone industry employed 965 persons, excluding officeworkers, who worked 1,793,885 man-hours. Three fatal and 30 nonfatal injuries were recorded, giving an injury-frequency rate of 16.7 per million man-hours of exposure.

METALS

Aluminum.—Kaiser Aluminum & Chemical Corp. put a new potline into operation to complete its four-line primary aluminum production plant near Ravenswood. The full capacity of the plant is estimated at 145,000 tons of aluminum per year. Late in the year the company put a new 2-Hi-bright stripmill into operation, to produce polished aluminum coil in widths up to 36 inches and in gages one-sixteenth of an inch or less for decorative trim.

Ferroalloys.—A wide variety of ferroalloys was produced by Union Carbide Metals Co. at Alloy and by Vanadium Corp. of America at Graham.

Iron and Steel.—Weirton Steel Co., Div. of National Steel Corp., and Wheeling Steel Corp., continued operation of four and one blast furnaces, respectively. Annual capacity of 2,646,000 tons, remained the same as 1958. Weirton Steel Co. also operated a basic open-hearth plant of 14 furnaces with annual capacity of 3.3 million tons and two Bessemer converters for providing molten metal to the open-hearth. Conners Steel Division of H. K. Porter had an electric-furnace capacity of 117,000 tons per year. Wheeling Steel Corp. purchased the strip and sheet mills of Follansbee Steel Corp. at Follansbee.

Nickel.—The International Nickel Co. of Canada, Ltd., produced a wide variety of fabricated nickel metal types at Huntington.

Zinc.—Matthiessen & Hegeler Zinc Co. operated a vertical-retort zinc smelter at Meadowbrook.

Zirconium.—Carborundum Metals Co., Inc., produced zirconium sponge at its Wood County plant, from Florida zircon.

REVIEW BY COUNTIES

Barbour.—Coal production decreased 4 percent in quantity and 8 percent in value. The number of underground mines decreased by

10, to 31, but underground output comprised 73 percent of the total. The remainder was from 19 strip (25 percent) and auger mines (2 percent). Clinchfield Coal Co. was the largest underground producer and Grafton Coal Co., the leading strip producer. The Mountain Fuel Co. abandoned its Glen Cambria mine at the end of the year. Clinchfield Coal Co. opened a new mine (Compass D) in June, and R. and B. Coal Co. started operations in February. Both companies employed over 20 men. Of the 82 percent of the underground production loaded mechanically, 13 percent was by continuous miners and 69 percent by mobile loading machines loading into shuttle cars and into mine cars. Bethlehem Cuba Iron Mines added a continuous miner, making a total of three for the county. Twenty-nine shovels, 2 draglines, 5 scrapers, and 33 bulldozers were used in stripping operations. Forty-one percent of the total production was cleaned, mostly using wet washing. A small tonnage was cleaned by pneumatic means. Fifty-nine percent of the coal was crushed, and 7 percent was treated with a combination of calcium chloride and oil. Most mining was in the Pittsburgh and Redstone seams, which averaged 80 and 66 inches thick, respectively.

Feather Construction Corp. of Morgantown produced crushed sandstone near Belington for use on State roads.

Berkeley.—Standard Lime & Cement Co., the only cement producer in West Virginia in 1959, manufactured portland and masonry cements at Martinsburg at a rate 17 percent higher than in 1958. The company reported completion of a new kiln and auxiliaries on September 1; their total of 6 kilns, ranging from 175 to 450 feet in length, operated an average of 240 days. Cement was shipped mostly to Maryland, Virginia, and the District of Columbia, for use chiefly by ready-mix concrete companies and manufacturers of concrete products.

Berkeley County was the largest limestone-producing area in West Virginia; the combined production of four companies (Standard Lime & Cement Co., Blair Limestone Div., Jones & Laughlin Steel Corp., W. S. Frey Co., and J. E. Baker Co.) increased 6 percent. Output was mostly used in manufacturing cement and lime and for ferrous metallurgy. The remainder of the output was used as railroad ballast and for concrete and roadstone.

The Blair Limestone Div. of Jones & Laughlin Steel Corp., produced captive lime chiefly for use in open-hearth steel furnaces.

United Clay Products Co., North Mountain, and Continental Clay Products, Martinsburg, mined miscellaneous clay for building bricks. Total clay production increased 19 percent.

Corning Glass Works started construction of a glass-cooking-utensils plant on a 60-acre site 4 miles south of Martinsburg, which will employ about 450 persons.

Boone.—Boone was the 10th ranking county in coal production in the State. Although the number of active mines continued to drop (18 less than in 1956), production increased 16 percent. Of the 31 underground mines, which comprised 90 percent of the county total, the largest ones were operated by Eastern Gas & Fuel Associates, Westmoreland Coal Co., Youghiogheny & Ohio Coal Co., North American Coal Corp., Red Parrot Mines, and Armco Steel Co. Strip and auger mines comprised 4 and 6 percent of total output, respectively.

TABLE 7.—Value of mineral production in West Virginia, by counties [1]

County	1958	1959	Minerals produced in 1959 in order of value [2]
Barbour	$14,542,104	$13,665,634	Coal, stone.
Berkeley	11,219,824	13,033,424	Cement, stone, lime, clays.
Boone	26,379,072	29,891,948	Coal.
Braxton	814,734	555,012	Do.
Brooke	(3)	2,133,681	Coal, sand and gravel.
Cabell	(3)	(3)	Sand and gravel, clays.
Calhoun		70,728	Stone.
Clay	(3)	(3)	Coal.
Fayette	30,991,144	25,178,142	Do.
Gilmer	1,557,298	1,601,889	Coal, stone.
Grant	(3)	257,517	Do.
Greenbrier	(3)	(3)	Do.
Hampshire		(3)	Stone.
Hancock	(3)	(3)	Clays, sand and gravel.
Hardy	145,600	(3)	Stone.
Harrison	29,355,409	28,635,986	Coal.
Jefferson	(3)	(3)	Stone, lime.
Kanawha	46,891,164	46,897,708	Coal, salt, bromine, clays, calcium chloride, stone, sand and gravel.
Lewis	2,679,494	3,432,982	Coal, stone, clays.
Lincoln	9,575	11,573	Sand and gravel.
Logan	79,212,992	78,698,697	Coal.
Marion	53,237,029	50,430,723	Do.
Marshall	(3)	(3)	Coal, salt.
Mason	(3)	(3)	Coal, salt, sand and gravel.
Mercer	5,303,902	4,199,793	Coal, clays.
McDowell	95,777,325	92,179,969	Coal.
Mineral	(3)	(3)	Coal, stone.
Mingo	29,606,338	32,036,918	Coal.
Monongalia	(3)	(3)	Coal, stone, sand and gravel.
Morgan	(3)	(3)	Sand and gravel.
Nicholas	23,947,648	23,861,766	Coal, sand and gravel.
Ohio	(3)	(3)	Do.
Pendleton	14,421	26,623	Stone.
Pocahontas	2,792,342	1,842,127	Coal.
Preston	(3)	8,481,813	Coal, stone.
Putnam	232,518	297,599	Coal.
Raleigh	(3)	39,932,401	Coal, sand and gravel.
Randolph	5,018,843	(3)	Coal, stone.
Roane		68,888	Stone.
Summers	49,383		
Taylor	588,399	273,985	Coal.
Tucker	1,275,393	414,671	Coal.
Upshur	4,770,190	4,834,237	Coal, stone.
Wayne	(3)	(3)	Coal, sand and gravel.
Webster	4,407,116	2,475,556	Coal.
Wetzel	(3)	(3)	Sand and gravel.
Wirt		44,873	Stone.
Wood	941,750	1,190,564	Sand and gravel.
Wyoming	(3)	(3)	Coal, sand and gravel.
Undistributed	277,985,331	231,228,865	
Total	[4] 749,747,000	737,886,000	

[1] The following counties did not report tonnage: Doddridge, Jackson, Pleasants, Ritchie, and Tyler.

[2] Natural gas, natural-gas liquids, and petroleum, not listed by counties; also includes a small amount of sand and gravel (1958), and gem stones not specified by county; included with "Undistributed."

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Revised figure.

Over 87 percent of the underground tonnage was mechanically loaded by 14 mobile loaders onto conveyors and by 46 into shuttle cars. Six continuous miners, two more than in 1958, loaded an additional 10 percent. Jigs cleaned 23 percent of the total tonnage; other wet-washing methods were used to clean 59 percent, and pneumatic methods were used to clean 5 percent; 22 percent was crushed, and 8 percent was treated with oil.

Braxton.—Coal from one strip and five underground mines was the only commodity produced in Braxton County. Production decreased one-third, and two less mines were active. A new mine employing 20 men was opened by H. B. Young Coal Co. in November. Calcium wet washing and air-box methods were employed at the Laurel cleaning plant of the Cedar Creek Coal Co. Nine hand-loaded face conveyors loaded 26 percent of the underground tonnage; and 2 mobile loaders, loading into shuttle cars, loaded 36 percent. The balance was hand loaded. Three-fourths of the county output was crushed. Mining was in the Pittsburgh and Clarion seams.

Brooke.—Coal production decreased 50 percent. Underground tonnage made up 47 percent of the output, strip 51 percent, and auger 2 percent. Of the nine reporting coal companies, Windsor Power House Coal Co. was the largest, producing captive tonnage for power generation. This company operated the only mechanized mine in the county, utilizing eight mobile loading machines. Preparation plants were operated by Windsor Power House and Penowa Coal Co. to clean their own production, and by the Cove Hill Coal Co. (Half Moon Cleaning Plant), for cleaning the output of local mines. All coal was from the Pittsburgh No. 8 seam, which averaged 54 inches in thickness.

Sand and gravel production was 84 percent less than in 1958, as Duquesne Sand Co.'s dredge moved to the Ohio side of the river. The Brilliant Sand Co., Follansbee, produced sand for fire or furnace use.

Cabell.—Sand and gravel was produced by the Ohio River Dredging Co. and Union Sand & Gravel Co. from the Ohio River near Huntington, chiefly for building and paving uses. Small quantities of sand for locomotive use and gravel for fill also were produced. Sand comprised 55 percent of the county output; gravel, 45 percent. An average of 34 men worked 270 days in sand and gravel operations.

The Barboursville Clay Manufacturing Co. mined miscellaneous clay and red shale for building brick near Barboursville.

Calhoun.—The Tri-State Stone Corp. operated a sandstone quarry and crushing plant near Pink and produced crushed sandstone for concrete aggregate and roadstone.

Clay.—Coal production declined 5 percent, even though the number of mines increased to eight. Four underground and four auger mines produced 70 and 30 percent of total output, respectively. The Elk River Coal & Lumber Co., the largest operator in the county for more than half a century and providing employment for approximately 1,000 men, was purchased by the Pittston Co. Ninety-four percent of the total output was cleaned (heavy medium) and crushed at the Widen tipple of the Elk River Coal & Lumber Co. Thirty-five percent was treated with calcium chloride and oil. Almost all the underground coal (99 percent) was mechanically loaded, chiefly by mobile loaders into shuttle cars. Five augers, 3 power shovels, 1 scraper, and 8 bulldozers were used in the auger operations, which also utilized 24 trucks of 15-ton average capacity.

Fayette.—Coal production decreased 7 percent in quantity and 19 percent in value. The number of active mines decreased from 162 to 129. Almost the entire output was from 120 underground mines. The largest underground mines were operated by the Semet Solvay Division of Allied Chemical Corp., The New River Co., Eastern Gas & Fuel Associates, Southern Coals Corp., Royalty Smokeless Coal Co., and Milburn Collieries. These companies mined three-fourths of the county total. Eighty percent of the underground tonnage was mechanically loaded. There were 14 continuous miners in use, an increase of 8 over 1958, as Eastern Gas & Fuel Associates and Royalty Smokeless Coal Co. added 6 and 2, respectively. However, 82 mobile loading machines loaded 87 percent of the mechanically loaded coal. Fifteen cleaning plants cleaned 67 percent of the coal; 20 percent was crushed; and 4 percent treated.

Gilmer.—Underground coal production increased almost 50 percent to comprise 67 percent of the county coal output. Strip production decreased approximately the same amount because of the closing of the Erie No. 4 strip mine of B. H. Swaney, Inc. The largest underground producer was Rochester & Pittsburgh Coal Co., which also opened a strip operation late in the year near Sand Fork. The new mine was expected to produce 5,000 tons a day of low-ash, low-sulfur Pittsburgh-seam coal. Three mobile loaders and one continuous miner loaded one-half of the underground coal. The O'Donnell cleaning plant of the Rochester & Pittsburgh Coal Co. used jigs. Forty-five percent of the total output was crushed.

Basil R. Heavner operated a portable crushing plant and produced crushed sandstone for use as concrete aggregate and roadstone.

Grant.—The closing of the strip and auger mines of Excavators, Inc., in April, caused a 20-percent decrease in coal production. The Lindsey Coal Mining Co. was the only strip producer and the largest company in the county. Moomau Coal Co. was the leading producer of the six underground properties. No coal was cleaned, crushed, or mechanically loaded.

Limestone for agriculture was produced by Keplinger & Co. near Maysville.

Greenbrier.—Coal tonnage and value decreased 38 and 41 percent, respectively, as the number of mines dropped from 99 to 77. The proportion of production mined by stripping methods increased from 27 to 41 percent, but underground mining decreased considerably and caused overall decreased production. Midland Coal Co., with four hand-loaded face conveyors, was the only mechanical-loading producer. Approximately one-fourth of the county total was cleaned by Lafayette Springs Coal Co. and Leckie Smokeless Coal Co., using calcium chloride and Kanawha heavy-medium methods, respectively. Nineteen percent was crushed, and a small tonnage was treated with oil. Five strip companies used 17 power shovels, 4 draglines, 16 bulldozers, and 24 trucks. Beech Run Coal Co. operated the only auger mine in the county.

The Acme Limestone Co. and The H. Frazier Co., Inc., both of Fort Springs, produced crushed limestone chiefly for concrete aggregate and roadstone and for railroad ballast. The remainder was used for chemical purposes, coal-mine dust, stone sand, and riprap.

Dimension sandstone (rough blocks) was produced by Greenbrier Quarries for architectural purposes.

Hampshire.—Crushed limestone for concrete aggregate and road-base material was produced at a quarry operated by Terra Alta Limestone Co. near Forks Capon, and from Williams Quarry, Inc.

Hancock.—Hancock County ranked first in clay mining and sand and gravel production in the State. The Globe Brick Co. and Crescent

Brick Co., both of Newell, and West Virginia Fire Clay Manufacturing Co., New Cumberland, mined plastic fire clay for use chiefly in making firebrick and block. Foundries, steelworks, and glass plants consumed the remainder.

Dravo Corp. opened a new dredge (No. 16) in July, supplementing dredges 8 and 9, for the production of sand and gravel. Production was reported for the first time in the county by Arroyo Sand & Gravel Co., near New Cumberland. Despite these additions, sand and gravel production decreased 12 percent, owing partly to the temporary removal of Dravo's No. 8 dredge from service during July. County output was almost entirely for structural uses. Sixty-two men worked an average of 168 days in the four sand and gravel plants.

Hardy.—Beans Lime & Stone, Inc., and Potomac Valley Soil Construction Co. crushed limestone for concrete and roadstone and agriculture. The Feather Construction Co., terminated its operation in the county in 1958.

Harrison.—Harrison County remained in eighth place in coal production, as virtually the same tonnage was produced from the same number of mines (102) as in 1958. Sixty-seven underground mines produced 75 percent of the output; 26 strip mines, 22 percent; and 9 auger mines, 3 percent. Keeley Construction Co. abandoned its three strip and three auger mines, and B. H. Swaney Co., its Erie No. 2 strip. A large new strip and auger operation was opened by the B. & B. Coal Co., of Mt. Clare. Smaller operations were opened by Miami Coal Co., Rivesville; Q & Q Coal Co., Buckhannon; Samstep Fuels, Inc., Summit Coal Co., and Frazier Coal Co., all of Clarksburg. Fifty-seven percent of the output was cleaned at seven plants operated by five companies, all using dense-medium methods. Eighty-nine percent of underground production was mechanically loaded by 9 mobile loaders into mine cars (4 less than 1958), 56 into shuttle cars (2 less than in 1958), and by 7 continuous miners (3 more than in 1958, as Mountaineer Coal Co., Frances Mining Co., and McCandlish Coal Co. each added one). Forty-three percent of the total production was crushed, and 9 percent was treated. Coal was mined chiefly from the Pittsburgh seam, which averaged 82 inches in thickness.

Jefferson.—Although output of stone decreased 6 percent, the county ranked second in stone production in the State. Crushed limestone was produced by Michigan Limestone Division, U.S. Steel Corp.; Blair Limestone Division, Jones & Laughlin Steel Corp.; and Standard Lime & Cement Co., Division of American-Marietta Co., all near Millville. The lime plant of Jones & Laughlin Steel Corp. had injury-free work experience for 66,051 man-hours and was awarded a certificate of achievement by the Federal Bureau of Mines. Over three-fourths of the limestone output was used as flux in open-hearth and blast furnaces. A portion of the dolomitic limestone output was burned to produce dead-burned dolomite. The major portion, however, was for concrete aggregate, roadstone, and agstone.

Calcerous marl was produced by the West Virginia Lime Co. near Charles Town and sold in raw sun-dried form for soil conditioning.

Kanawha.—Coal production decreased 2 percent, but the county remained fourth in the State. Of the total production, 90 percent was produced at 88 underground mines. The major portion (94 percent) of underground production was mechanically loaded, mostly by mobile loading machines (84 percent). Nine continuous miners produced 14 percent, and 29 hand-loaded face conveyors, 2 percent of the mechanically loaded coal. Production was 67 percent mechanically cleaned. Of this amount, 69 percent was cleaned by jigs, and 13 percent, by pneumatic means, and 18 percent, by wet-washing methods other than jigs. Almost half of the county tonnage was crushed and one-tenth was treated with oil and calcium chloride. Five strip and eight auger mines were active. The Bell Creek mine operated by Union Carbide Metals Co., Division of Union Carbide Corp., worked 124,840 man-hours without a lost-time accident. The North American Coal Corp, and Warner Collieries merged during the year to become the North American Coal Corp., Southern Division. Truax-Traer mines were transferred to Oglebay Norton Co. in September. Carbon Fuel Co. abandoned its No. 4 mine November 25. The Valley Camp Coal Co. abandoned its KC No. 6 mine on October 27. Richard Mining Co., employing 20 men, opened near Chesapeake in February.

Westvaco-Chlor-Alkali Div., Food Machinery & Chemical Corp., increased production of brine (salt) for manufacturing chlorine, 64 percent over 1958. The company also produced bromine and calcium-magnesium chloride, but output was a third less than in 1958, as this plant was closed by a strike during the year.

The West Virginia Brick Co. mined flint fire clay, and Charleston Clay Products Co., mined plastic clay for building brick, near Charleston.

A quarry was operated by Mazella Quarries near Charleston to produce crushed sandstone for concrete aggregate and roadstone. Pfaff & Smith Builders Supply Co. did not operate in the county in 1959.

Saint Albans Sand Co. produced engine sand near Saint Albans.

E. I. du Pont de Nemours & Co., Inc., continued to recover brimstone at its Belle Plant using the Thylox process.

Lewis.—The four strip and three auger coal mines of Lewis County comprised 55 and 44 percent of output, respectively. The only underground mining was done by Weston State Hospital for its own use. Due to increased production by Bitner Fuel Co., Keeley Construction Co., and Christopher Mining Co., coal output was 21 percent greater than in 1958. The McWhorter mine of B. H. Swaney, Inc., closed during the year. There were 5 augers, 10 bulldozers, and 11 trucks used in the auger mines, and 22 power shovels, 18 bulldozers, and 14 trucks used in the strip mines. Coal was mined mainly from the Pittsburgh seam which averaged 50 inches in thickness. Overburden thickness averaged 44 feet. Jigs and hydroseparators cleaned 29 percent of the county total; 90 percent was crushed.

Crushed sandstone was produced by Feather Construction Corp. near Buckhannon, and Weston Stone Co. near Weston.

The Jane Lew Brick & Tile Co. plants 1 and 2 near Jane Lew continued to produce miscellaneous clay for building brick, building tile, and draintile.

Lincoln.—Dial Co., Branchland, and Davis & Adkins Sand Co. and Dean Coal & Sand Co., both of Ferrelsburg, produced sand for building. Production decreased 5 percent from 1958.

Logan.—The county led the State for the fifth consecutive year in bituminous-coal production. Production increased slightly (1 percent) as the number of active mines increased by 5, to 80; 96 percent of the coal was mined underground—3 and 1 percent from strip and auger mines, respectively. Princess Elkhorn Coal Co. and Powellton Coal Co. of Huntington merged and formed Princess Coals, Inc. Island Creek Coal Co. took over Elk Creek Coal Co. (Nos 1 and 4 mines) and the Guyan Eagle Coal Co. (Nos. 1, 4, and 5). Amherst Coal Co. opened a new mine in September. With these additional mines, Amherst Coal Co. and Island Creek Coal Co. operated a total of 14 mines (7 each) and employed 2,395 men. The Gay Coal & Coke Co. closed permanently in January. A total of 200 machines loaded 98 percent of the underground total and consisted of 193 mobile loaders handling 98 percent, and 7 continuous miners, 2 percent. Eighty-nine percent was mechanically cleaned in 22 plants, and 10 percent was crushed.

Marion.—Although only 15 mines were active, the county ranked fifth of the 35 coal-producing counties in the State. Virtually all coal was mined underground from 11 mines. The remainder was produced at four strip mines. The Virginia & Pittsburgh Coal & Coke Co. was idle for the second consecutive year. Two-thirds of the coal was cleaned, 24 percent by jigs, 6 percent by pneumatic, and the remainder by other wet-washing methods, chiefly jigs and gravity table combinations. Almost the entire county output was loaded mechanically. Mobile loaders (64) loaded 40 percent in shuttle cars, and continuous miners (42) loaded 60 percent. There were 9 less mobile loaders and 11 more continuous miners in use. One-third of the output was crushed.

Marshall.—Coal production (all underground) increased 85 percent, the greatest increase of any county in the State. This was due to tripling the output of Hanna Coal Co.'s Ireland mine, as full-scale operation was achieved for the first time since its April 1957 opening. The mine employed an average of 400 men, two shifts a day for 260 days. Mechanical loading by 16 continuous miners (an increase of 5) into shuttle cars handled 93 percent of underground production. Almost three-fourths of the county output was crushed, and four-fifths was cleaned.

A 19-percent increase in salt output resulted from increased production by Columbia Southern Chemical Corp. (New Martinsville) and The Solvay Process Division, Allied Chemical Corp. (Moundsville). The salt, in brine form, was used in manufacturing chemicals (chiefly chlorine).

Mason.—Increased coal production (43 percent) by 13 bituminous-coal mines was chiefly due to the opening of 4 new mines during the year. The new companies were Double B Coal Co. (underground), River Coal, Inc. (strip), and Universal Fuel & Chemical Co. (underground and strip). Of the total tonnage, 81 percent was mined underground; 9 percent from strip operations; and 10 percent from auger mines. The Pittsburgh No. 8 seam, which averaged 57 inches in thickness, was mined. Seventy percent of the coal was crushed. There was no treatment or mechanical cleaning. The entire underground production was by mobile loading machines, except for a small tonnage loaded by two hand-loaded face conveyors.

Evaporated salt was produced in open pans or grainers by Liverpool Salt Co., Hartford. Output was used by ice manufacturers, feed dealers and mixers, and by water-softener companies.

Sand and gravel for road paving was dredged from the Ohio River near New Haven by the Letart Sand & Gravel Co.

McDowell.—The County ranked second in the State in coal production. Although the number of mines decreased from 204 to 152, production decreased only 3 percent, and the number of active coal mines remained the largest in the State. No large mines were abandoned during the year; but the small high-cost hand-loading operations were abandoned. There were 21 cleaning plants, which cleaned 84 percent of the coal: 26 percent by jigs, 22 percent by pneumatic methods, and 52 percent by other wet-washing methods. Over 90 percent of underground production was mechanically loaded. Machinery included 120 mobile loaders (17 less than in 1958) and 60 continuous miners (14 more than in 1958, with additions by Eastern Gas & Fuel Associates, Island Creek Coal Co., Pocahontas Fuel Co., and United States Steel Corp.).

Mercer.—Production and value of coal decreased 10 and 21 percent, respectively, due to the drop in active mines from 25 to 16. The largest production declines (88 percent) occurred in strip mining, as only one mine was active, compared with seven in 1958. Strip and auger mining each comprised 3 percent of total output; underground, 94 percent. Mining was from the Pocahontas Nos. 3 and 6 seams, averaging 44 inches in thickness. Four augers, 1 power shovel, 1 bulldozer, and 4 trucks serviced the 4 auger mines. Ninety-seven percent of total output was cleaned in 4 cleaning plants. Nearly 10 percent was treated with oil for dust control. Mobile loaders loaded 96 percent of the underground coal into shuttle cars. Crozer Coal & Land Co. added 2 mobile loaders and Pocahontas Fuel Co. added 1, increasing the total to 13.

A small quantity of miscellaneous clay was mined for building brick and draintile by Virginia Brick & Tile Co. of Princeton.

Mineral.—Although the number of active coal mines remained the same (9), production decreased by one-half. Of the county tonnage, 41 percent was mined underground, 56 percent at strip, and 3 percent at auger mines. Underground mining was all at hand-loading operations. One-fifth of the coal was crushed, but none was mechanically cleaned.

Crushed limestone was produced near Keyser by the Spencer Lime Co. Output was used entirely for concrete and roadstone, except for a small tonnage used for agriculture.

Mingo.—Mingo County rose from the ninth-ranked position in coal production to seventh, as production increased 11 percent. Forty-eight mines were active, an increase of 11 over the previous year. Underground mining comprised 96 percent of total output. Almost 90 percent of the county total was mined by Ames Coal Co., Crystal Block Coal & Coke Co., Island Creek Coal Co., and Massey Coal

Mining Co. Twelve cleaning plants operated by 7 companies cleaned 96 percent of total output. A little over one-fifth of the output was crushed, and a small tonnage was treated with oil. Ninety-seven percent of the underground tonnage was loaded by 57 mobile loaders and 6 continuous miners into shuttle cars, an addition of 4 continuous miners since 1958, as Island Creek added 2 and Massey Coal Co., began continuous mining with 2 machines at Ben Creek No. 2. Changes in ownership included Kimberling Collieries to S. B. and O. Coal Co.; Burning Springs Collieries to Burning Creek Coal Corp.; and The Sycamore Coal Co. to Princess Coals, Inc. Mining Enterprises, Inc., abandoned its auger operation in December. A new operation was opened by Deep Ford Coal Co.

Monongalia.—Although the number of mines decreased by 5, to 64, coal production increased almost 5 percent. Sixty of the mines were underground and accounted for over 99 percent of output. Christopher Coal Co., National Coals, Inc., South Union Coal Co., and Valley Camp Coal Co., were the largest producers. Their output comprised 94 percent of the total production. Approximately three-fourths of the coal was cleaned. Of this total, 19 percent was by jigs, 80 percent by other wet-washing methods (chiefly sand flotation), and 1 percent by pneumatic methods. Tasa Coal Co.'s Canyon tipple serviced various small mines in the area. Nearly 98 percent of underground coal was mechanically loaded, by 30 mobile loading machines and 27 continuous miners (5 more continuous miners than 1958 due to the addition of 5 by Christopher Coal Co.). Trotter Coal Co. sold its Bunker mine to Christopher Coal Co. in April, and Christopher Fuel Corp. was purchased by National Coals, Inc., in November. Morris Coal Co., Inc., sold its Mason-Dixon mine to L. & W. Coal Co., Inc., in June. Caro Coal Co. abandoned its Camp Run mine in May, and Lake Lynn Fuel Co. abandoned its Lynn mine in May.

Greer Limestone Co. and Lambert Bros., Inc., crushed limestone at stationary plants near Greer, primarily for concrete aggregate and roadstone. Keely Construction Co. also produced crushed sandstone for concrete aggregate and roadstone uses.

Glass and engine sands were produced by Deckers Creek Sand Co., near Masontown. The plant employed 43 men for 158 days.

Morgan.—The Berkeley Works of Pennsylvania Glass Sand Corp., near Berkeley Springs, continued full-scale operation in the production of sand for glass manufacture, plus ground sand, chiefly for abrasives, pottery, porcelain, and tile.

Nicholas.—The number of coal mines increased by 17, to 91, but the additions were small operations and did not effect a corresponding increase in production. Ninety percent of the tonnage was mined underground at 82 mines, 8 percent was mined at 5 strip mines, and 2 percent at 4 auger mines. Eleven cleaning plants were active, cleaning 54 percent of the output. A little over 10 percent was crushed, and 8 percent was treated. Eighty-four percent of underground coal was mechanically loaded by mobile loading machines, continuous miners, and hand-loaded face conveyors. Johnstown Coal & Coke Co. added a continuous miner. Strip mining utilized 12 power shovels, 8 bulldozers, and 24 trucks, which traveled an average of 4 miles from pit to tipple. Overburden excavated averaged 32 feet in thickness. The Baldy Coal Co. abandoned its strip and auger mines in October, and J. & F. Coal Corp. closed its Jerry Fork mine in September. M. & G. Coal Co. started operations in April with hydrotators and air tables as preparation facilities. A fire swept through the preparation plant of Tioga Coal Corp. on May 23 and leveled two sections of the tipple and caused damage estimated at $750,000.

Building sand was produced by Nettie Sand Co. near Nettie.

Ohio.—One strip and three underground coal mines were active. Production increased 16 percent over 1958. All coal was mined from the Pittsburgh No. 8 seam, which averaged 62 inches in thickness. Ninety-eight percent of the coal was cleaned by a combination of jigs and tables. One third of the county output was crushed, and 43 percent treated with calcium chloride and oil. Virtually all underground coal was mechanically loaded by six mobile loaders.

The Delta Concrete Co. (formerly H. L. Seabright Co.) operated a dredge on the Ohio River near Wheeling and produced building sand and gravel. The plant employed 16 men for 258 days during the year.

Pendleton.—Ruddle Lime Co., Franklin, and North Fork Lime Producers, Riverton, produced crushed limestone for agriculture.

Pocahontas.—Twenty-two percent less coal was produced than in 1958. Two less underground mines reduced the active total to 11. Murphy & Noonan Coal Co. and Maust Coal & Coke Co. abandoned mines during the year. Knob Coal Co. purchased the underground mine of Nichols & Bailes. Ninety-one percent of the coal was mined underground by nine mines; about three-fourths was mechanically loaded.

Preston.—Underground coal production increased 13 percent, as the number of mines increased from 65 to 76. There were two auger mines active, compared with one in 1958, and auger output almost tripled. Strip mines increased by 2 to 13, but production decreased 10 percent. Underground mines produced 69 percent of the county output, strip mines 30 percent, and auger mines 1 percent. A little less than one-third (31 percent) of the underground coal was mechanically loaded by four mines, using hand-loaded face conveyors and two mines using mobile loading machines. No coal was cleaned.

Joyce W. Clark purchased the Leston mine from Leston Supply Co., and Evert's Coal Co. purchased Ream No. 2 mine from Kray Coal Co. The Roxie Ann Coal Co., Inc., purchased the J. & M. Mining Co. in May, and Sandy Creek Fuel Co. purchased the Industrial Coal Co. in August. Nancy Coal Co., Inc., purchased the No. 3 mine from the Brenneman Coal Co. The latter company also permanently closed its No. 2 mine in September. Lewis Coal & Coke Co. took over the Omega Mining Co. Mersing Coal Co. abandoned its No. 2 underground mine in May.

Alpha Portland Cement Co. permantly closed its cement plant and reported no production in 1959.

Terra Alta Limestone Co. continued the production of crushed limestone for concrete aggregate and roadstone at its semiportable plant near Aurora.

Consolidated Supply Co. operated the Yough stone plant near Aurora and produced a small amount of dimension sandstone.

Putnam.—Underground coal mining increased 7 percent; total county output decreased 2 percent, as there was no auger mining in 1959. Strip mining was discontinued in 1957. The 13 underground operations were small hand-loading truck mines. Output was from the Pittsburgh seam, which averaged 61 inches in thickness.

Raleigh.—Due to a 16-percent decrease in coal production, Raleigh dropped from the sixth-ranked coal-producing county in the State to ninth. Underground mines which numbered 126, comprised 95 percent of the county total; 7 strip mines comprised 3 percent; and 8 auger mines comprised 2 percent. Truax-Traer mines were transferred to Oglebay Norton in September. Eastern Gas & Fuel Associates closed its Stotesbury mine. New River Company abandoned its Cranberry mine, and Raleigh-Wyoming Coal Co. abandoned all its mines (Nos. 2, 6, and Edwight) late in 1958. Lillybrook Coal Co.'s Killarney and Affinity mines were idle. These shutdowns resulted in four less cleaning plants, reducing the total to 16. Of total production, 69 percent was cleaned, 32 percent by jigs, 23 percent by pneumatic methods, and 19 percent by other wet-washing methods. Eighty-five percent of the underground coal was loaded mechanically. Mobile loaders handled 86 percent, continuous miners 8 percent, and hand-loaded face conveyors 6 percent. The Hunter mine of Republic Steel at Coal City worked 233,938 man-hours without a lost-time injury and ranked second in the Bituminous Coal group of the National Safety Competition.

Building sand was produced from stationary plants near Beaver by Table Rock sand plant and Beaver Block Co.

Randolph.—Coal production increased by 5 percent, and the total number of mines rose to 26 from 19. Twenty underground mines, an increase of five, made up 81 percent of the total; four strip mines, 18 percent; and two auger mines, 1 percent (there were no auger mines in 1958). L. E. Cleghorn Coal Co. opened four underground mines during the year. Four-fifths of underground coal was loaded mechanically by 5 mobile loaders, 7 continuous miners, and 27 hand-loaded face conveyors. Continuous miners increased by 4, as Peerless Coals, Inc., added 2, and L. E. Cleghorn utilized 2 at its new operations. There was no cleaning in the county but over one-third of the production was crushed.

Crushed limestone was quarried near Elkins by Elkins Limestone Co., for concrete aggregate and roadstone and stone sand.

Roane.—A sandstone quarry was operated by the Tri-State Stone Corp., near Spencer, to produce crushed stone for concrete aggregate, and roadstone.

Taylor.—Because of the discontinuance of strip and auger mining, coal production decreased 57 percent. However, underground production increased 52 percent and the number of mines increased from 7 to 17. Significant mine closings were L. E. Cleghorn and the strip and underground mines of Mason Bros. The active mines were small hand-loading operations. None of the coal was mechanically cleaned, but a small tonnage was crushed.

Tucker.—The North East Coal Co., the second largest county coal producer in 1958, was idle, which resulted in a two-thirds decrease in coal production. One underground mine was active, but virtually all the coal was mined from four strip mines, three of which were new operations opened by Mountain View Coal Co., Beaver Mining & Quarry Co., and Blackwater Coal Co., Inc.

Anderson, Inc., a limestone producer, discontinued operations.

Upshur.—Strip mining decreased 50 percent but increased underground mining (11 percent), and resumption of auger mining (discontinued in 1956) held total output at the 1958 level. Underground mining at 23 pits accounted for 89 percent of the total coal; 7 strip and 1 auger mines comprised 10 and 1 percent, respectively. The Redstone Coal Mining Co., Inc., abandoned its operation. Eighty-seven percent of the underground coal was mechanically loaded by six mobile loaders (68 percent), and two continuous miners (32 percent) into shuttle cars. There were 12 power shovels and 10 bulldozers used in the strip mines. A little over half of the coal was cleaned, 66 percent was crushed, and a small tonnage was treated.

Sandstone was crushed at a portable plant by Basil R. Heavner for use as concrete aggregate and roadstone.

Wayne.—Coal production increased 29 percent, as four additional underground mines were active (total of six). Coal was mined from the No. 5 Block seam, and all was hand loaded.

Engine and traction sand was produced by the Laval Sand Co., Inc., near Fort Gay.

Webster.—Coal production decreased 44 percent, because three mines were shut down. Five of the nine underground mines were mechanized and loaded 98 percent of the underground total, using 13 mobile loaders, 4 hand-loaded face conveyors, and 2 continuous miners. Williams River Coal Co. added a continuous miner. Eighty-six percent of the coal was cleaned at three mechanical cleaning plants.

Wetzel.—The Ohio Valley Sand Co. and the Ohio River Sand & Gravel Corp. operated plants near New Martinsville and produced building and paving sand and gravel plus gravel for fill and railroad ballast.

Wirt.—A sandstone quarry (Vandal Farm) operated by the Tri-Stone Corp., near PeeWee, produced crushed stone for concrete aggregate and roadstone.

Wood.—Sand and gravel production increased nearly one fourth. Active producers were Ohio River Sand & Gravel Co. and Kanawha Sand Co., both of Parkersburg, and Pfaff & Smith Builders Supply Co.

Wyoming.—The county continued as the third ranking coal producer. Although there was no change in the number of mines (66), production increased 5 percent. Ninety-four percent of the coal was mined by 57 underground mines, 5 percent by 8 strip mines, and 1 percent by 1 auger mine. Oglebay Norton Coal Co. took over the Brule Smokeless Coal Co. during the year. Island Creek Coal Co. discontinued strip and auger mining in the county. Eighty-four percent of the coal was cleaned at 17 preparation plants. Ninety-five percent of underground coal was loaded mechanically by mobile loaders, continuous miners, and hand-loaded face conveyors.

Casto & Lackey Sand Co. produced engine (traction) sand near Kimball.

The Mineral Industry of Wisconsin

This Chapter Has Been Prepared Under A Cooperative Agreement for Collection of Mineral Data, Between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wisconsin.

By Lenox H. Rand [1]

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WISCONSIN'S mineral output reached a new high of $71.9 million in 1959, exceeding the 1958 record of $71.3 million. Total value of nonmetallic mineral commodities identified with road building and construction increased, reflecting a continued high level of expenditure for Government-sponsored highway construction programs. Among the metallic minerals, iron ore shipments were below the abnormally low 1958 figure. During the latter part of the year, zinc-lead production was stimulated by the improved outlook for zinc.

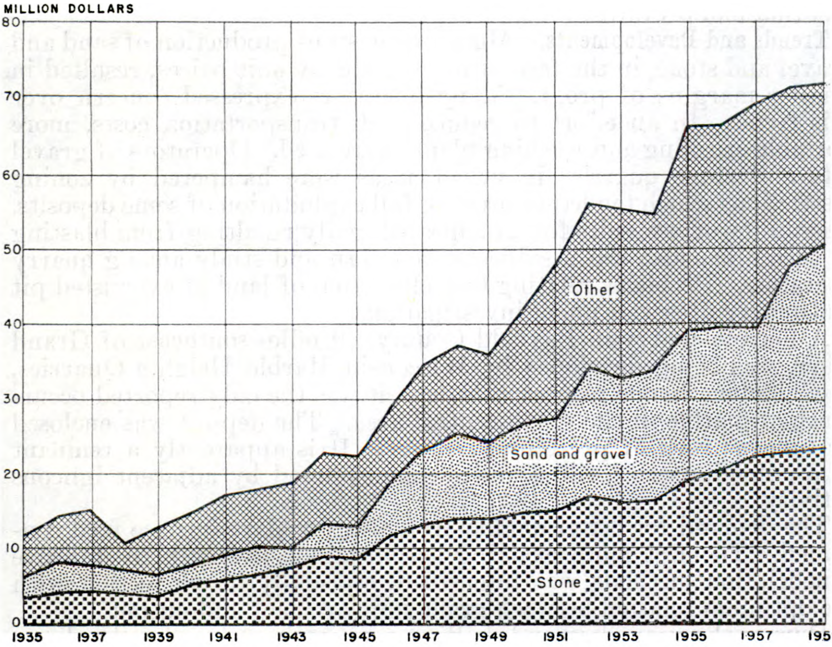

FIGURE 1.—Value of sand and gravel, stone, and total value of all minerals produced in Wisconsin, 1935–59.

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[1] Commodity-industry analyst, Bureau of Mines, Region V, Minneapolis, Minn.

Consumption, Trade, and Markets.—Road and highway construction in Wisconsin sustained production of sand and gravel, crushed stone, and cement at near record levels. Curtailment of allotments by the Federal Government to the State in support of the road-building program during the year affected the rate of contract-letting more than actual output of raw materials. However, the abrupt cancellation, early in October, of contracts for construction at the Richard Bong Air Base near Racine did create a depressing effect in that vicinity. Output and consumption of nonmetallic minerals used for industrial purposes increased because of generally improved business conditions.

A 116-day steel strike, settled in early November just before the close of the shipping season on the Great Lakes, disrupted production and water transport of iron ores. Output and shipments declined sharply from the 20-year low levels of the previous year. However, even in the face of apparent shortages, demand by furnace operators for higher grade and better quality iron ores continued unabated. The economic position of Wisconsin's underground iron mines did not improve. There was no change in the base price for iron ores during the year.

The outlook for the zinc-lead producing area in the southwestern part of the State brightened perceptibly toward the end of the year. Production at several properties was resumed. The position of zinc with regard to market price, consumption, and stocks on hand was the best that had prevailed for several years.

Trends and Developments.—Mounting costs of production of sand and gravel and stone, in the face of low but steady unit prices, resulted in smaller margins of profit. Many operators expressed concern over this trend. In an effort to reduce high transportation costs, more portable crushing and washing plants were used. Operators of gravel pits and stone quarries in urban areas were hampered by zoning restrictions which tended to prevent full exploitation of some deposits. Possibility of law suits for damages allegedly resulting from blasting in such areas also was a subject of concern and study among quarry operators. Problems relating to reclamation of land at exhausted pit and quarry sites were under investigation.

A marble quarry in Bayfield County, 10 miles southeast of Grand View, was being developed by Wisconsin Marble Heights Quarries, Inc. Unique in one respect, this deposit was the only reported occurrence of marble in the north-central area. The deposit was enclosed by igneous rock of pre-Cambrian age. It is apparently a remnant of a dolomite series, tilted and metamorphosed by adjacent igneous activity.

The demand for better quality iron ores for blast furnace feed continued. To meet more exacting specifications, research to improve beneficiation methods was intensified, especially in connection with the optimum relation between grade improvement and output.

During the year, diamond drilling was conducted under the direction of several mining companies in Douglas, Bayfield, Ashland, and Iron Counties. This drilling was exploratory in character, designed to test the possibility of extensions into this area of the iron and copper formations from known occurrences in Michigan. Favorable legislation for water rights for exploitation of large low-grade magnetic iron ore deposits in the vicinity of Butternut in Ashland County was considered by the State legislature.

TABLE 1.—Mineral production in Wisconsin [1]

Mineral	1958		1959	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Abrasive stones: Pebbles (grinding) and tubemill liners	858	$26	770	$27
Clays .... thousand short tons	154	167	178	192
Iron ore (usable) .... thousand long tons, gross weight	867	(2)	701	(2)
Lead (recoverable content of ores, etc.)	800	187	745	171
Lime .... thousand short tons	141	2,193	(2)	(2)
Peat	(2)	(2)	7,500	(2)
Sand and gravel .... thousand short tons	39,383	25,845	41,999	27,535
Stone .... do	13,722	23,334	13,522	23,782
Zinc (recoverable content of ores, etc.)	12,140	2,477	11,635	2,676
Value of items that cannot be disclosed: Cement and values indicated by footnote 2	----------	18,083	----------	18,541
Total Wisconsin [3]	----------	71,334	----------	71,959

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Figure withheld to avoid disclosing individual company confidential data.
[3] Total adjusted to eliminate duplication in the value of clays and stone.

TABLE 2.—Summary of employment and injuries for selected mineral industries in Wisconsin [1]

Year and commodity	Average number of men working	Total man-hours	Total number of lost-time injuries		Total number of days lost or charged	Injury frequency rate [2]	Injury severity rate [3]
			Fatal	Nonfatal			
1958							
Clay [4]	34	25,564	----------	----------	----------	----------	----------
Granite	179	381,586	----------	17	(5)	44.55	(5)
Limekiln [6]	125	318,992	----------	7	(5)	21.94	(5)
Limestone [7]	1,244	1,929,519	----------	89	(5)	46.13	(5)
Marl	8	5,776	----------	----------	----------	----------	----------
Sand and gravel	3,441	5,263,112	1	88	8,347	16.91	1,586
Sandstone	88	145,249	----------	7	(5)	48.19	(5)
1959							
Clay [4]	70	76,932	----------	2	16	26.00	208
Granite	159	310,955	----------	11	(5)	35.37	(5)
Limekiln [6]	124	324,345	1	10	(5)	33.91	(5)
Limestone [7]	1,294	1,996,875	1	78	(5)	39.56	(5)
Marl	8	5,630	----------	----------	----------	----------	----------
Sand and gravel	1,418	2,281,278	----------	41	858	17.97	376
Sandstone	115	209,276	----------	1	(5)	4.78	(5)

[1] Data exclude office workers; are final for 1958 and preliminary for 1959.
[2] Defined as the total number of injuries per million man-hours.
[3] Defined as the total number of days lost or charged per million man-hours.
[4] Excludes pits producing clay used exclusively in manufacturing cement.
[5] Figure not available.
[6] Includes lime plants and quarries producing limestone used in manufacturing lime.
[7] Excludes quarries producing limestone used exclusively in manufacturing lime.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—A slight decline in output of grinding pebbles and tubemill liners was reported by Baraboo Quartzite Co., in 1959. These items were made from hard quartzite found near Baraboo in Sauk County. The use of pebbles as the grinding medium in ball-and-tubemills increased because of economy and freedom of the ground products from contamination by iron. However, competition from use of harder pebbles imported from Europe and synthetic materials manufactured in the U.S. was increasingly severe.

Cement.—Portland cement was manufactured at two plants in Wisconsin—the Manitowoc Portland Cement Co., a subsidiary of Medusa Portland Cement Co., at Manitowoc; and a unit of the Marquette Cement Manufacturing Co. of Chicago, at Milwaukee. Shipments increased about 5 percent, reflecting a high level of activity in road building and generally improved economic conditions. There was no increase in capacity at either plant, but both operated at a higher percentage of existing capacity. Clay used as an ingredient of the cement made at Manitowoc was mined at a local pit and transported to the plant by a 6-inch hydraulic pipeline. At Milwaukee, shale from Illinois was used in place of clay. The limestone for both plants was shipped in from Michigan. Cement clinker, made in Indiana by Universal Atlas Cement Co., was ground at Milwaukee. Storage silos were maintained in Milwaukee and Green Bay by Huron Portland Cement Co. for portland cement made in Michigan. Production of this cement was credited to the originating States. All cement produced in Wisconsin was of type I and II—general use and moderate heat. A small portion of portland cement made at Milwaukee was converted to masonry cement. The average mill value per 376-pound barrel of portland cement in Wisconsin declined slightly to $3.26 from $3.30 in 1958.

Clays.—The use of miscellaneous clay as a raw material in the manufacture of cement and in the fabrication of brick, tile, and other heavy clay products increased 16 percent in 1959. The demand for facing brick and tile was much improved. Abnormally wet weather and Federal financial assistance encouraged the installation of drain-tile in farming areas. Production of clays was reported by 8 companies from pits in 7 counties. No production was reported by two former operators in La Crosse County.

Lime.—There was a small increase in the output and total value of quick and hydrated lime in 1959. Production was reported from Brown, Dodge, Douglas, Fond du Lac, and Manitowoc Counties by four companies operating six plants. The Valders Lime and Stone Co., Valders, did not produce lime during the year. In order of decreasing quantities, the consumption of lime used was as follows: Paper manufacture, mason's lime in the building industry, water purification, metallurgy, insecticides, polishing compounds, paint, and agriculture. About 30 percent of the quicklime produced was hydrated before shipment.

Perlite.—Crude perlite from several western States was expanded at plants in Milwaukee and Outagamie Counties. The plant of Badger Lightweight Products Co. in the Milwaukee area was acquired by Western Mineral Products Co. late in 1959. Expanded perlite was used chiefly in lightweight concrete and plaster. Output of the expanded material declined nearly 30 percent in 1959.

Sand and Gravel.—Production and value of sand and gravel increased to 42 million tons and $27.5 million, respectively, gains of more than 6 percent from the previous (1958) record. Unit prices remained virtually constant. Output was reported from 60 of the 71 counties. Proportion of output by commercial producers to that by Government-and-contractor operators was 52 percent, compared with 47 percent in 1958. About 91 percent of the total output of sand and gravel was used in building and paving—83 percent was for paving.

Of the total output of sand and gravel by both commercial producers and Government-and-contractor operators, 66 percent was used for road building; the remaining 34 percent was consumed in building and industry. These figures clearly indicated the importance of the highway-construction programs to the economy of the State.

While the total value of nonmetallic minerals used in connection with highway construction represented the greatest source of income from Wisconsin's minerals, the output of industrial sands governed solely by industrial demand was a better guide to basic economic conditions. Production of these sands for use in metal foundries as foundry and molding sands and for sand blasting, filter, and filler, increased 42 percent above the low level of 1958, and demand was strong at the close of the year. Preparation of industrial sands for market required specialized equipment or a deposit so free from contaminants that only sizing was necessary.

Cutbacks and a slowdown in Federal support of highway-construction programs during 1959 caused confusion and concern among State authorities and contractors, but subsequently a lower level of annual expenditures was indicated until trust-fund reserves could be built up to required levels.

Competition among suppliers of sand and gravel remained keen, and the trend to more exacting specifications on size and quality of materials for concrete aggregates continued. The use of portable plants at pits adjacent to projected routes increased and many of the larger road-building contractors undertook to supply their own raw materials. The proportion of sand and gravel transported by truck as compared with rail was 90 percent in favor of trucks, about the same as in 1958. To effect a greater movement of sand and gravel by rail, exhaustive studies of the problems involved were made.[2]

The ten leading commercial operators reporting production in 1959, in alphabetical order, were: Consumers Co., Division of Vulcan Materials Co., Chicago; Frederich, Loots & Below, Inc., Oshkosh; Hartland Sand & Gravel, Hartland; Janesville Sand & Gravel Co., and Wm. J. Kennedy & Son, Janesville; Koepke Sand & Gravel Co.,

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[2] Jensen, Ellis E., More Short-Haul Traffic: National Sand and Gravel Association, Feb. 12, 1958, p. 24.

Appleton; Edward Kraemer & Son, Plain; F. F. Mengel Co., Wisconsin Rapids; A. J. Reiske Sons Co., and State Sand & Gravel Co., Milwaukee.

Stone.—Stone output in Wisconsin included limestone, granite, quartzite, sandstone, basalt, marl, argillite, and andesite; the latter two served as raw material for the State's important contribution of natural and colored roofing granules. Quantity and value of all stone, 13.5 million tons and $23.7 million, showed only minor changes compared with corresponding figures for 1958. Crushed limestone, used chiefly for road construction, accounted for most of the total output. Variations among the several categories of stone produced were slight, and no special trends were indicated.

The widespread deposits of thinly bedded limestone, especially in eastern Wisconsin, continued to yield dimension stone of good quality

TABLE 3.—Sand and gravel sold or used by producers, 1958–59, by classes of operations and uses

	1958		1959	
	Short tons (thousands)	Value (thousands)	Short tons (thousands)	Value (thousands)
COMMERCIAL OPERATIONS				
Sand: [1]				
Molding	63	$127	66	$124
Building	2,432	2,005	3,079	2,591
Paving	1,740	1,382	2,363	1,924
Railroad ballast	20	7	108	86
Fill	1,285	769	1,320	648
Other	30	59	11	10
Undistributed [2]	61	133	111	229
Total	5,631	4,481	7,058	5,612
Gravel:				
Building	2,685	2,498	3,423	3,028
Paving	8,163	6,015	9,511	7,095
Railroad ballast	391	271	522	380
Fill	1,315	625	1,222	637
Other	253	153	261	148
Total	12,807	9,563	14,939	11,288
Total sand and gravel	18,437	14,044	21,997	16,900
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	58	22	1	(3)
Paving	11,766	5,721	11,844	5,698
Fill			161	50
Total	11,824	5,743	12,006	5,748
Gravel:				
Paving	9,122	6,058	7,971	4,878
Fill			25	9
Total	9,122	6,058	7,996	4,887
Total sand and gravel	20,945	11,801	20,002	10,635
ALL OPERATIONS				
Sand	17,454	10,224	19,064	11,360
Gravel	21,928	15,621	22,935	16,175
Grand total	39,383	25,845	41,999	27,535

[1] Includes friable sandstone.

[2] Includes filler sand (1958), engine, blast, and filter (1958–59), oil (hydrafac) foundry uses, and other industrial sand (1959).

[3] Less than $1,000.

for building construction and house veneer. Production of this type of stone was reported from 28 producers in 9 counties.

Crushed and broken limestone was mined from quarries in 34 counties. Most of this material was used for concrete aggregate and roadstone for building and highway construction. Smaller quantities were consumed in the manufacture of lime and for agricultural, industrial, and chemical purposes. Due to severe competition among producers, unit prices remained steady despite rising costs, which remained a major problem for operators.

The 10 leading commercial producers of crushed and broken limestone, listed alphabetically were: Becker & Tuckwood, Lancaster; Consumers Co., Division of Vulcan Materials Co., Chicago; Franklin Stone Products, Inc., Hales Corners; Halquist Lannon Stone Co., Sussex; Edward Kraemer & Sons, Inc., Plain; Arthur Overgaard, Inc., Elroy; Quality Limestone Products, Inc., Sussex; P. W. Ryan Sons, Inc., Janesville; Waukesha Lime & Stone Co., Waukesha; and George Wendtlandt, Mineral Point.

Granite, cut and dressed or polished, chiefly for building and monumental uses, was quarried in Marathon, Marquette, and Waushara Counties. Some of the waste material at the dimension-granite quarries was crushed for concrete aggregates. In addition, in Marathon County near Mosinee, large quantities of decomposed granite were excavated from weathered outcroppings of a granite intrusion and used for local road surfacing. The value of this latter material was much lower than the value of the hard, unaltered granite produced elsewhere in the county.

A variety of other stone types were quarried in Wisconsin. Sandstone, quartzite, andesite, argillite, and basalt were crushed and sized mainly for road surfacing, concrete aggregate, and railroad ballast and for special purposes such as abrasives, roofing granules, glass, refractories, and filters. Some sandstone was used as flagging and

TABLE 4.—Limestone sold or used by producers, by uses [1]

Use	1958		1959	
	Quantity (thousands)	Value (thousands)	Quantity (thousands)	Value (thousands)
Dimension:				
Rough construction.................short tons..	5	$20	12	$81
Rubble..................................do....	22	88	28	105
Rough architectural..................cubic feet..	13	14	3	3
Dressed (cut and sawed)...................do....	476	1,066	498	1,153
Flagging..................................do....	109	94	126	116
Total equivalent short tons [2]......................	75	1,282	90	1,458
Crushed and broken:				
Riprap..............................short tons..	100	78	40	31
Concrete aggregate and roadstone..........do....	9,707	9,981	9,704	9,987
Agriculture...............................do....	1,241	1,687	1,292	1,793
Other [3]..................................do....	348	468	334	464
Total.....................................do....	11,396	12,214	11,370	12,275
Grand total...............................do....	11,471	13,496	11,460	13,733

[1] Includes both commercial and Government-and-contractor production.

[2] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.

[3] Includes limestone for magnesia plants (1958), alkali works (1959), flux, railroad ballast, paper mills asphalt, fertilizer, filter beds, lime, and other uses (1958–59).

rubble and in rough construction. Production of the above named varieties of stone was reported by eight companies in Clark, Columbia, Marathon, Marinette, Polk, and Portage Counties. Special uses required relatively high-cost materials and accounted for a substantial portion of the total value of all stone in Wisconsin.

A small output of marl was reported by seven producers in Portage, Waupaca, and Waushara Counties. It was used entirely for agricultural purposes.

METALS

Iron Ore.—In the face of generally improving economic conditions in 1959, the iron ore industry was adversely affected by the 116-day steel strike. Mining and water transportation of iron ores came to an abrupt halt. Shipment and production of iron ores declined nearly 20 percent from the 20-year low set in 1958. At yearend, stocks were high because the strike-interrupted shipping season on the Great Lakes was so short.

The entire output of iron ore in Wisconsin came from two underground and two open-pit mines. The former were the Montreal and the Cary on the Gogebic range in Iron County operated respectively by Oglebay, Norton & Co., and Pickands Mather & Co.; the latter were the Badger and the Meress on the Menominee range in Florence County operated by Zontelli Brothers, Division of Pittsburgh Pacific Co.

All ore produced was of direct-shipping grade. From the Gogebic range, ore was moved by rail to ore docks at Ashland and thence by boat to lower Lake ports. Ore from the Menominee range was shipped partly by rail to the ore docks at Escanaba and partly by rail directly to consuming centers. Shipments from the port of Ashland began April 24 and ended November 18.

There was no change of the base prices per long ton for iron ores posted January 30, 1957, as follows: High Phosphorus, $11.45; Mesabi Non-Bessemer, $11.45; Mesabi Bessemer and Old Range Non-Bessemer, $11.70; and Old Range Bessemer, $11.85. Prices for iron ore included all shipping costs from the mines to lower Lake ports; these costs do not appear in the total value of iron-ore output of Wisconsin. The base prices were for ores grading 51.50 percent iron (natural) and for Bessemer ores less than 0.045 percent phosphorus (dry). Ores higher than 0.18 percent phosphorus (dry) were classed as High Phosphorus. Variations in grade from this base, as well as diversities in physical structure from established norms, called for premiums or penalties.

TABLE 5.—Iron-ore production and shipments

Year	Number of mines	Production (thousand long tons)	Shipments (thousand long tons)	Iron content of shipments natural (percent)
1955	3	1,589	1,886	52.03
1956	3	1,551	1,488	52.49
1957	3	1,618	1,576	52.32
1958	2	1,152	867	53.72
1959	4	944	701	53.39

Except for exploratory diamond drilling and prospecting in the counties bordering Lake Superior, no other iron mining activities were reported in the State.

Lead and Zinc.—Better zinc prices resulted in resumed operations at these four mines: Piquette mine of the Piquette Mining Co. in Grant County; the Temperly-Thomson and Blackstone mines of the Vinegar Hill Zinc Division, American Zinc, Lead and Smelting Company; and the Birkett-Bastian-Andrews mine of Eagle Picher Co. in Lafayette County. Both Vinegar Hill Division mines and the Piquette mine resumed operations December 7, 1959. They had been closed since 1957. The Birkett-Bastian-Andrews mine resumed operation in August 1959; it had been closed since September 1958. Production from these operations began too late in the year to effect an increase in the State's production of lead and zinc over 1958. The production of lead was 7 percent less and that of zinc 4 percent less than in 1958.

The average weighted yearly price per pound used to calculate the values of both lead and zinc in table 1 in 1959 was 11.5 cents, compared with 11.7 cents for lead and 10.2 cents for zinc in 1958. The general range of market prices for lead, New York, was as follows: Opened 1959 at 13 cents per pound, declined to 12 cents per pound January 21, ranged between 11.5 and 11 cents from February 11 to May 7, rose to 12 cents on May 7, to 13 cents on August 24, declined to 12.5 cents on December 14, and to 12 cents on December 21. Zinc market prices, East St. Louis, opened 1959 at 11.5 cents per pound, declined to 11 cents February 25, rose to 12 cents September 21, and to 12.5 and 13 cents from October 20 until November 2 when the price was established at 12.5 cents.

TABLE 6.—Mine production of lead and zinc, in terms of recoverable metals

Year	Mines producing		Material treated		Lead		Zinc		Total value
	Lode	Tailings	Ore (short tons)	Tailings (short tons)	Short tons	Value	Short tons	Value	
1950–54 (average)	19	6	483,005	35,086	1,456	$432,613	14,886	$4,284,193	$4,716,806
1955	10	5	583,731	31,831	1,948	580,504	18,326	4,508,196	5,088,700
1956	14	5	828,579	139,346	2,582	810,748	23,890	6,545,860	7,356,608
1957	16	3	710,776	17,066	1,900	543,400	21,575	5,005,400	5,548,800
1958	2	----------	468,822	----------	800	187,200	12,140	[1] 2,476,560	2,663,760
1959	6	----------	464,390	----------	745	171,350	11,635	2,676,050	2,847,400

[1] Revised figure.

TABLE 7.—Mine production of lead and zinc in 1959, by months, in terms of recoverable metals, in short tons

Month	Lead	Zinc	Month	Lead	Zinc
January	35	600	August	60	1,300
February	60	715	September	65	1,150
March	50	710	October	50	1,090
April	65	750	November	80	1,475
May	65	810	December	90	1,590
June	60	745			
July	65	700	Total	745	11,635

REVIEW BY COUNTIES

Mineral production was reported from 70 of the 71 counties. Many of the larger road building contractors operated portable plants in various counties but did not break down output by counties. Thus, all counties probably contributed to production of sand and gravel or stone. Among commercial operators, 182 showed output of sand and gravel and 111 produced crushed limestone. Noncommercial or Government-and-contractor operators included State and county highway departments, cities, towns, and full-time contractors for Federal or State projects. Production of minerals not directly connected with road construction or concrete for building was reported from only 29 counties. These minerals included dimension stone, special sands, quartzite, marble, andesite, argillite, marl, and peat among the nonmetallic group and zinc, lead, and iron ores among the metallics.

Ashland.—No new work was done at the large, low-grade magnetic iron ore deposit of Ashland Mining Co. near Butternut, but studies and plans to bring the property into production were continued. Exploratory diamond drilling was reported by Atkins-Walker Co., for the Snyder Mining Co., on optioned land in the same area. Cold Spring Granite Co., Cold Spring, Minnesota, produced granite from its quarry near Mellen.

Barron.—Output of sand and gravel was reported by Ostermann Sand & Gravel Co., Inc., Turtle Lake, and Pioneer Sand & Gravel Co., Rice Lake. The Barron County Highway Department, Barron, mined and prepared road material.

Bayfield.—Wisconsin Marble Heights Quarries, Inc., Eau Claire, produced dolomitic marble from its quarry near Grand View. This deposit is the only reported occurrence of marble in Wisconsin. Studies and experiments were made to develop special uses for this material.

Brown.—Production of sand and gravel and crushed limestone for road work was reported by 13 operators. Among the largest producers were: Allard & Van Nelson, Fred Kropp, and Schuster Construction Co. all of Green Bay; W. B. Sheedy, Pulaski; and Daanen & Janssen and Scray Quarries of De Pere. The Village of Howard and the Brown County Highway Department produced road material. Leo and Nels Scray, De Pere, quarried dimension limestone.

Duck Creek Brick Co. and Hockers Brothers Brick & Tile Co., Green Bay, mined miscellaneous clay for brick and other heavy clay products.

The Western Lime & Cement Co., Milwaukee, made quick and hydrated lime at its plant in Green Bay. Sales were for industrial and chemical use.

Buffalo.—Herbert Tiffany, Jr., Nelson; and J. Allen Wiles, Cochrane, produced crushed limestone for roads and agricultural uses. The Buffalo County Highway Department, Alma, produced roadstone.

Calumet.—Sand and gravel was produced by the Calumet Company and Arnold M. Ortlepp, Chilton; Quality Sand & Gravel Co., Wrightstown; and Sells Brothers Stone & Gravel Co., Stockbridge. Sand and gravel and limestone were produced by the Calumet County Highway Commission, Chilton.

TABLE 8.—Value of mineral production in Wisconsin, by counties[1]

County	1958	1959	Minerals produced in 1959 in order of value
Adams	(2)	(2)	Sand and gravel.
Ashland		(2)	Stone.
Barron	$257,096	(2)	Sand and gravel.
Bayfield		(2)	Stone.
Brown	1,111,564	$1,230,889	Sand and gravel, stone, lime, clays.
Buffalo	(2)	(2)	Stone.
Burnett	90,599	171,790	Sand and gravel, stone.
Calumet	143,420	187,505	Do.
Chippewa	23,500	19,730	Sand and gravel.
Clark	109,969	129,891	Sand and gravel, stone.
Columbia	(2)	(2)	Stone, sand and gravel.
Crawford	129,477	203,268	Do.
Dane	1,238,947	1,683,855	Sand and gravel, stone.
Dodge	1,045,801	797,975	Lime, stone, sand and gravel.
Door	(2)	(2)	Sand and gravel, stone.
Douglas	(2)	(2)	Lime, sand and gravel.
Dunn	(2)	332,212	Sand and gravel, stone, clays.
Eau Claire	(2)	(2)	Sand and gravel.
Florence		(2)	Iron ore.
Fond du Lac	1,109,699	1,095,429	Stone, sand and gravel, lime, clays.
Forest	71,884	64,549	Sand and gravel.
Grant	644,714	533,900	Stone, zinc, sand and gravel, lead.
Green	(2)	483,623	Stone, sand and gravel.
Green Lake	189,923	259,798	Sand and gravel, stone.
Iowa	360,292	442,018	Stone, sand and gravel.
Iron	(2)	(2)	Do.
Jackson	(2)	111,500	Sand and gravel.
Jefferson	167,045	160,247	Sand and gravel, stone.
Juneau	(2)	(2)	Stone, sand and gravel.
Kenosha	390,654	426,650	Sand and gravel.
Kewaunee		98,226	Do.
La Crosse	218,864	94,509	Sand and gravel, stone.
Lafayette	2,727,554	(2)	Zinc, lead, stone.
Langlade	225,955	295,895	Sand and gravel.
Lincoln	(2)	(2)	Do.
Manitowoc	(2)	(2)	Cement, sand and gravel, lime, stone, clays.
Marathon	7,010,127	6,691,290	Stone, sand and gravel, clays.
Marinette	(2)	(2)	Stone, sand and gravel.
Marquette	370,727	(2)	Do.
Milwaukee	5,023,207	5,637,496	Cement, stone, sand and gravel.
Monroe	81,446	85,729	Stone.
Oconto	282,605	314,934	Sand and gravel.
Oneida	219,731	142,622	Sand and gravel, stone.
Outagamie	459,000	323,900	Stone, sand and gravel.
Ozaukee	225,491	89,895	Sand and gravel.
Pepin	(2)	(2)	Stone.
Pierce	385,822	340,279	Sand and gravel, stone.
Polk	(2)	677,199	Stone, sand and gravel.
Portage	214,655	410,472	Sand and gravel, stone.
Price	7,549	1,699	Sand and gravel.
Racine	1,347,339	1,677,608	Stone, sand and gravel, clays.
Richland	(2)	(2)	Stone, sand and gravel.
Rock	1,341,082	1,325,628	Sand and gravel, stone.
Rusk	71,680	80,650	Sand and gravel.
St. Croix	399,776	696,716	Sand and gravel, stone.
Sauk	1,662,162	1,242,697	Stone, sand and gravel, abrasives.
Sawyer	94,926	68,671	Sand and gravel.
Shawano	263,072	474,010	Sand and gravel, stone.
Sheboygan	394,160	363,288	Do.
Taylor	323,258	(2)	Sand and gravel.
Trempealeau	251,588	(2)	Stone.
Vernon	(2)	(2)	Stone, sand and gravel.
Vilas	41,697	56,500	Sand and gravel.
Walworth	305,592	272,109	Do.
Washington	604,925	1,029,451	Sand and gravel, stone.
Waukesha	5,465,484	6,382,187	Sand and gravel, stone, peat.
Waupaca	(2)	(2)	Stone, sand and gravel, clays.
Waushara	(2)	(2)	Stone.
Winnebago	1,551,459	1,884,696	Sand and gravel, stone.
Wood	(2)	(2)	Stone.
Undistributed [3]	33,655,493	33,831,446	
Total [4]	71,334,000	71,959,000	

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[1] Washburn County is not listed because no production was reported.

[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[3] Includes sand and gravel and stone that cannot be assigned to specific counties and values indicated by footnote 2.

[4] Total adjusted to eliminate duplicating value of clays and stone.

Clark.—Charles Marek, Sr., Merrillan; Paul Brothers, Owen; and Plautz Brothers, Willard, produced sand and gravel for roads and buildings. Clark County Highway Department provided material for roads.

Sandstone for building construction and flagging was quarried by Ellis Quarries, Inc., Stevens Point.

Columbia.—Portage-Manley Sand Co., Rockton, Ill., produced a large quantity of high-quality glass and foundry sand from its sandstone quarry near Portage. Analysis of representative samples of this sandstone showed more than 99.5 percent silica. Moderate blasting was used to break the sandstone from a face about 75 feet high. Depth of removed overburden ranged from 10 to 50 feet. The broken stone was crushed, dried, and screened; most of the product was shipped by rail. Demand was good all year. Francis James, Doylestown, shipped untreated foundry sand from a nearby deposit.

Sand and gravel for building and paving were produced by Columbia Ready Mix Co., Pardeeville and A. T. Riese Trucking Co., Wisconsin Dells. The Columbia County Highway Department mined sand and gravel for roadwork. Dann & Wendt, Rio, and Edward Kraemer & Sons, Inc., Plain, crushed limestone for roads.

Crawford.—Output of sand and gravel and crushed limestone was reported. Leading producers were: Prairie Sand & Gravel Co., and Loren J. Slaught of Prairie du Chien, and Edward Kraemer & Sons. Inc., Plain.

Dane.—Mineral output consisted entirely of sand and gravel and crushed limestone used for road building and construction. The larger producers reporting were: Boehnen, Inc., Cross Plains; Hartland-Verona Gravel Co., Verona; Capitol Sand & Gravel Co., Madison Sand & Gravel Co., Madison Stone Co., Speedway Sand & Gravel Co., and Hammersley Stone Co., all of Madison; and Baumgardt Construction Co., Dodgeville. The Dane County Highway Department produced roadstone.

Dodge.—Mayville White Lime Works, Mayville, and Western Lime & Cement Co., Milwaukee, produced limestone for lime, metallurgical use, and roadstone. The former made quicklime at its plant near Mayville, and the latter manufactured both quick and hydrated lime at its Knowles plant, where five shaft kilns were in use.

Melvin Voigt, Ashippun, produced sand and gravel for roads. The Dodge County Highway Department produced sand and gravel for roadbuilding and repair.

Door.—Materials for construction and roads were produced by Vernon E. Olsen Excavating Co. and the Door County Highway Department, Sturgeon Bay, and Herbert Charles, Luxemburg. Some dimension limestone was quarried in the county.

Douglas.—Cutler-LaLiberte-McDougall Corp., Duluth, Minn., the largest producer of lime in the State, manufactured quicklime in its plant at Superior for chemical and industrial uses. The plant was equipped with two rotary kilns. Douglas County Highway Department and the City Engineer, Superior, reported sand and gravel production for roads.

Dunn.—The Menomonie Brick Co., Menonomie, made brick with clay mined from a pit adjacent to its plant. Edward Kraemer &

Sons, Inc., Plain, and Red Cedar Sand & Gravel Co., Menomonie, produced sand and gravel for construction and roadwork and the Barron County Agricultural Agent quarried and pulverized limestone for agricultural uses.

Eau Claire.—Special sands for blast, engine, filter, and foundry uses were prepared at the modern plant of Eau Claire Sand & Gravel Co. This plant and others in the county also produced sand and gravel for building and highway construction. The Eau Claire City Engineer reported a small output of sand and gravel for streets.

Florence.—A relatively small output of iron ore from the Badger and Meress open-pit mines on the Menominee range near Florence was reported by Zontelli Brothers Division of Pittsburgh Pacific Co., Ironton, Minn. The quality of ore from these properties, with regard to grade (silica and phosphorus content) and structure, was not equal to that of ores from the deep, underground mines on the Gogebic range. Thus, market outlets were restricted.

Fond du Lac.—The larger producers of construction and roadbuilding materials were: Braun Construction Co. and Lake View Sand & Gravel Co., Fond du Lac; Nellis Limestone Quarry, Inc., Ripon; M. A. Leiberg, Oakfield; C. C. Linck, Inc., Beaver Dam; Schroeder Brothers Sand & Gravel Co., Kiel; and the Fond du Lac County Highway Department.

Dimension limestone for building and house veneer was quarried by Fond du Lac Stone Co., Inc., Fond du Lac; and Oakfield Stone Quarry, Allentown, from ledge-type limestone deposits.

The Oakfield Shale Brick & Tile Co., Oakfield, mined clay for its manufacture of heavy clay products and Western Lime & Cement Co., Milwaukee, quarried limestone to make both quick and hydrated lime at its Eden plant, where five shaft kilns were used.

Grant.—The Piquette mine and mill, the county's chief producer of zinc and lead, reopened December 7, 1959. The company continued to sell jig tailings for road use.

Sand and gravel and crushed limestone production were reported by Becker & Tuckwood, Lancaster, and crushed limestone output, only, by Bertie & Russell Zenz, Bloomington; Dell Needham, Feenimore; and George Wendtlandt, Mineral Point.

Green.—Substantial quantities of construction and roadbuilding materials were produced by Green County Sand & Gravel Co., Rees Construction Co., and Green County Highway Commission, all of Monroe, and P. W. Ryan & Sons, Inc., Janesville.

Green Lake.—Molding sand was produced by Chier St. Marie Sand Co., Berlin. Building- and paving-material output was reported by Clifford Chier Sand Co., and Peterson Gravel Co., Berlin; Kopplin & Kinas Co., Inc., and Green Lake County Highway Department, Green Lake; Paul Polenska & Son, Manchester; and Gaastru Brothers, Friesland.

Iowa.—Sand and gravel or limestone was produced by Davis & Richardson, Spring Green; Wonn & Martin, Cobb; Ivey Construction Co., and George Wendtlandt, Mineral Point; and Iowa County Highway Department, Dodgeville.

Iron.—The Montreal and Cary underground iron ore mines on the Gogebic range were operated by Oglebay Norton & Co. and Pickands

Mather & Co., respectively. Abnormally low outputs were attributed to the steel strike.

Juneau.—The Juneau County Highway Commission, Mauston, produced sand and gravel for roadwork and Arthur Overgaard Co., Elroy, mined and crushed limestone at its large quarry 6 miles east of Elroy.

Kenosha.—Sand and gravel for building and road construction was produced by Bloss Sand & Gravel Co., Salem; Consumers Co., Division of Vulcan Materials, Chicago; Director of Parks, Kenosha; and the Kenosha County Highway Department, Silver Lake.

La Crosse.—No production of clay was reported from this county in 1959. Kemmel-Smith Sand & Gravel Co., Inc.; La Crosse Sand & Gravel Co., Inc.; and the La Crosse County Highway Department produced sand and gravel, mostly for building.

Lafayette.—Eagle Picher Co. operated the Shullsburg mine and mill throughout the year and reopened the Birkett-Bastian-Andrews mine in August. Lead and zinc ore from the latter mine was hauled by truck to the company Graham mill near Galena, Ill. Vinegar Hill Zinc Division of American Zinc, Lead and Smelting Company reopened the Blackstone and the Temperly-Thompson mines December 7. Ore was treated at the nearby company mill.

Crushed limestone was produced by Albert Ruef, Darlington, and George Wendtlandt, Mineral Point.

Langlade.—Output of sand and gravel for construction and roadwork was reported by Duffek Sand & Gravel, Inc., and Langlade County Highway Department, Langlade.

Manitowoc.—Manitowoc County retained its lead in cement output. The Manitowoc Portland Cement Co. manufactured cement at Manitowoc; the plant had four rotary kilns ranging in length from 160 to 340 feet and all 10 feet in diameter. The company mined its own clay from a nearby pit, but because of a low M_gO requirement for the crude mix, all limestone used was shipped in from Michigan.

Quick and hydrated lime for building, chemical, and industrial uses was made by the Rockwell Lime Co., Chicago, Ill., at its plant near Francis Creek. A rotary kiln and a batch-type hydrator were used. The Valders Lime & Stone Co., Valders, discontinued lime production, but produced dimension limestone for veneer, flagstone, and other building uses. Substantial quantities of sand and gravel were produced by R. & J. Fricke Co., Kasper Construction Co., Manitowoc County Highway Department, and Fred Radandt Sons, all of Manitowoc; and Shroeder Brothers Sand & Gravel Co., Kiel.

Marathon.—Argillite for roofing granules and quartzite for abrasives were produced at the Greystone and Rib Mountain quarries near Wausau. The crude material, mined and crushed by Foley Brothers, Inc. under contract with Minnesota Mining and Manufacturing Co., St. Paul, Minn., was shipped to finishing plants for final processing.

Dimension granite for building and monuments was produced by Anderson Bros. & Johnson Co., Lake Wausau Granite Co., Prehn Granite Quarries, Inc., Wausau; Wisconsin Quarries, Inc., Schofield; and Cold Spring Granite Co., Cold Spring, Minn.

Large quantities of a soft, disintegrated material were dug by power shovels from outcroppings of weathered granite near Mosinee and used locally for road surfacing.

Ellis Quarries, Inc., Stevens Point, quarried and dressed standstone for buildings; clay was produced by Marshfield Brick & Tile Co., Marshfield, to make heavy clay products. Output of sand and gravel was reported by Riverside Gravel Co., Heiser Ready Mix Co., and Lutz Sand & Gravel Co., Wausau.

Marinette.—Andesite was quarried, crushed, and sized at the large, modern plant of Central Commercial Co., Chicago, Ill., 10 miles east of Pembine, to produce both natural and colored roofing granules. A small quantity of sand and gravel also was produced in the county.

Marquette.—Granite for monuments was quarried and polished by Montello Granite Co., Montello. Sand and gravel and crushed limestone, respectively, were produced by the Marquette County Highway Department, Montello; and Edward Kraemer & Sons, Inc., Plain.

Milwaukee.—Cement was manufactured at the plant of Marquette Cement Mfg. Co., Chicago, Ill., in Milwaukee. The shale and the limestone used in the raw material were shipped from Illinois and Michigan respectively.

Major quantities of sand and gravel and crushed limestone were produced in the county. Large operators were: Consumers Company, Division of Vulcan Materials Co., Chicago, Ill.; Edward Lutz Sand & Gravel Co., K. & N. Sand & Gravel Co., and Wauwatosa Stone Co., Milwaukee; Ray Anderson Sand and Gravel Co., Moritz Sand & Gravel Co., and Franklin Stone Products, Inc., all of Hales Corners.

Pierce.—Molding, blast, filtration, hydrafrac, and other special sands were mined and prepared by Bay City Sand Co., Inc., Bay City; and Maiden Rock Silica Sand Co., Maiden Rock.

Sand and gravel and crushed limestone were produced by River Falls Sand & Gravel Co., River Falls; Rush River Sand & Gravel Co., Ellsworth; Sanders Stone & Lime Co., Mount Horeb; Edward Kraemer & Sons, Inc., Plain; and the Pierce County Highway Department.

Polk.—Output of crushed basalt for concrete aggregate and road surfacing material was continued by the Dresser Trap Rock Co., Dresser. A Bureau of Mines Information Circular describing the blasting technique at this quarry was published.[3]

The Polk County Highway Department produced road construction and maintenance materials, and the Polk County Agricultural Agent, Balsam Lake, ground limestone for soil conditioning. Sand and gravel output was reported by Roy Pearson, Luck; Horsmann Ready Mix, Dresser; and Roy Bohn, Frederic.

Portage.—Sandstone for flagging and construction was quarried by Ellis Quarries, Inc., Stevens Point. Sand and gravel production was reported by Wimme Sand & Gravel and Portage County Highway Department, Stevens Point; and F. F. Mengel Co., Wisconsin Rapids.

Caldwell's Dredging Co., Waupaca; and Bert Somers, Stevens Point, excavated and sold small tonnages of marl.

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[3] Marshall, L. G., Coyote-Hole Primary Blasting, Dresser Trap Rock Co., Dresser, Wis.: Bureau of Mines Inf. Circ. 7913, 1960, 18 pp.

Racine.—Consumers Company, Division of Vulcan Materials Co., Chicago, Ill., quarried large quantities of limestone near Racine. Hillside Sand & Gravel Co., Racine; Edward Kraemer & Sons, Inc., Plain; J. W. Peters & Sons, Burlington; and the U.S. Air Force, Burlington, had important outputs of sand and gravel.

Cessation of work at the Richard Bong Air Base lowered production in this area.

Union Grove Drain & Tile Co., Union Grove, produced miscellaneous clays for making heavy-clay products.

Rock.—This county was prominent for production of sand and gravel and crushed limestone for building and road construction. The larger operators were: Atlas Sand & Gravel Co., Janesville Sand & Gravel Co., Little Limestone Co., P. W. Ryan Sons, Inc., and Rock County Highway Department, all of Janesville; Edgerton Sand & Gravel Co., Edgerton; and Chicago, Milwaukee, St. Paul & Pacific Railroad Co., Chicago, Ill.

St. Croix.—Dimension stone for building and veneer was quarried by St. Croix Valley Stone Co., Stillwater, Minn. Large quantity producers of construction and road materials were: Edward Kraemer & Sons, Inc., Plain; St. Croix County Highway Department, Hammond; Wilson Rock & Limestone Co., Wilson; and Leary Construction Co., River Falls.

Sauk.—Quartzite for railroad ballast was produced from a large quarry at Rock Springs by Foley Brothers, Inc., St. Paul, Minn., for the Chicago and Northwestern Railway Company. This hard, durable quartzite proved to be excellent ballast material. Quartzite for refractory, abrasive, and grinding uses also was produced by General Refractories Co., Philadelphia, Pa.; Harbison-Walker Refractories Co., Pittsburgh, Pa.; and Baraboo Quartzite Co., Baraboo. A large output of sand and gravel and crushed limestone was reported by Edward Kraemer & Sons, Inc., Plain; W. R. Dubois & Son, Inc., Deppe Lumber Co., Baraboo Concrete Products Co., W. W. Deppe, all of Baraboo; and Craig Seaman, Reedsburg. Dimension stone for flagging and veneer was quarried by Alfred Boyles Flagstone Quarry, Rock Springs.

Waukesha.—Eighteen operators produced dimension stone for construction, architectural, and veneer uses from ledge-type limestone deposits prominent in the area. The major operators included: Halquist Lannon Stone Co. and Quality Limestone Products, Inc., Sussex; Sussex Lannon Stone Corp., Pewaukee; Conoco Building Products, Inc., Midwest Lannon Stone Co., and Milwaukee Lannon Stone Co., Lannon.

The county also produced the most sand and gravel and crushed limestone in Wisconsin. Major operators were: Consumers Company, Division of Vulcan Materials Co., Chicago, Ill.; Jaeger Sand & Gravel Co., State Sand & Gravel Co., and Reiske Sand & Gravel Corp., all of Milwaukee; Frank Clark & Sons, West Allis; Hales Corners Sand & Gravel Co., and Hribar Sand & Gravel Co., Hales Corners; Hartland Sand & Gravel Co., Hartland; Kohler Bros. Sand & Gravel Co., Bodus Brothers Sand & Gravel Co., Valley Sand & Gravel Co., and Waukesha Lime & Stone, Inc., all of Waukesha; Palmer Crushing Co., Colgate;

Frank Pernat, Jr., Oconomowoc; Loth Sand & Gravel Co., Brookfield; and Braun Construction Co., Fond du Lac.

Peat was produced by Demilco, Inc., Milwaukee.

Winnebago.—Large quantities of construction and roadbuilding materials were produced. The major producers were: Courtney & Plummer, Inc., Neenah; Schultz Sand & Gravel, Inc., and Koepke Sand & Gravel Co., Appleton; Frederich, Loots, and Below, Inc., Oshkosh; Badger Highways Co., Inc., Menasha; and Consumers Company, Division of Vulcan Materials Co., Chicago, Ill.

Wood.—Sandstone for construction and flagging uses was quarried and dressed by Ellis Quarries, Inc., and Felix Klesmith, Stevens Point; and Tony Schmick, Wisconsin Rapids.

Other Counties.—Some counties not listed had substantial outputs of sand and gravel and crushed limestone for building and highway construction uses but no production of other minerals. In addition to county highway departments the larger commercial operators in these counties were: Belongia Construction Co., Asa Foster, and John Jaworski in *Oconto County;* Edward Kraemer & Sons, Inc., Adolph Riemer, M. J. Zimmerman Construction Co., and Edward J. Murphy Sand & Gravel Co. in *Shawano County;* Cascade Sand & Gravel Co., Crystal Lake Crushed Stone Co., and Elkhart Moraine Sand & Gravel Co., in *Sheboygan County;* Edward Kraemer & Sons, Inc., and Ellefson Brothers in *Vernon County;* B. R. Amon & Sons, Mann Brothers Sand & Gravel, Inc., R. W. Miller, and J. F. Thorpe in *Walworth County;* and J. B. Jacklin, Kleist Sand & Gravel Co., Ozaukee Sand & Gravel Co., West Bend Sand & Stone Co., Schmidt Services, Inc., Northern Sand & Gravel Co., and Reiske Sand & Gravel Corp. in *Washington County.*

A few counties with only minor production of roadbuilding materials not specifically mentioned are listed in the county table.

The Mineral Industry of Wyoming

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wyoming.

By F. J. Kelly,[1] William H. Kerns,[1] and D. H. Mullen[1]

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SMALL but significant increases in the value of output of nearly all minerals in Wyoming occurred in 1959. The value rose to $391.6 million, compared with $369.9 million in 1958.

The mineral fuels continued to dominate the industry in terms of value ($340.2 million), accounting for 87 percent of the total worth. Coal output in 1959 was 21 percent above 1958, the first increase since 1955, and reversed the downward trend in the value of output of this commodity.

Cement, clays, and sand and gravel, in the nonmetals group, declined in value; no feldspar was mined in 1959. The value of output for the group was $30.8 million, 5 percent above 1958.

TABLE 1.—Mineral production in Wyoming[1]

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate .... short tons, gross weight..	17	$9	1	----------
Clays [2]	1,075	9,968	764	$9,449
Coal	1,629	5,820	1,977	6,669
Gem stones	(3)	52	(3)	76
Gold (recoverable content of ores, etc.) .... troy ounces..	117	4	----------	----------
Gypsum	6	19	9	31
Iron ore (usable) .... thousand long tons, gross weight..	557	(4)	503	2,923
Natural gas .... million cubic feet..	121,682	10,221	[5] 123,500	[5] 10,700
Natural-gas liquids:				
Natural gasoline .... thousand gallons..	49,451	3,052	64,586	4,003
LP-gases .... do....	54,496	2,614	90,314	3,951
Petroleum (crude) .... thousand 42-gallon barrels..	115,572	301,643	[5] 125,968	[5] 314,920
Phosphate rock .... thousand long tons..	124	937	(4)	(4)
Pumice	45	40	94	77
Sand and gravel	5,333	4,760	4,692	3,982
Stone	1,099	1,472	1,317	1,791
Uranium ore .... short tons..	651,790	13,286	864,582	17,610
Value of items that cannot be disclosed: Cement, copper (1958), feldspar (1958), fire clay and miscellaneous clay (1959), sheet mica (1959), silver (1958), sodium carbonate (natural), sodium sulfate, vanadium (1958), and values indicated by footnote 4	----------	16,760	----------	15,970
Total Wyoming [6] [7]	----------	369,938	----------	391,621

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay and miscellaneous clay (1959); value included with "Items that cannot be disclosed."

[3] Weight not recorded.

[4] Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed."

[5] Preliminary figure.

[6] Excludes recoverable elemental sulfur.

[7] Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement.

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[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

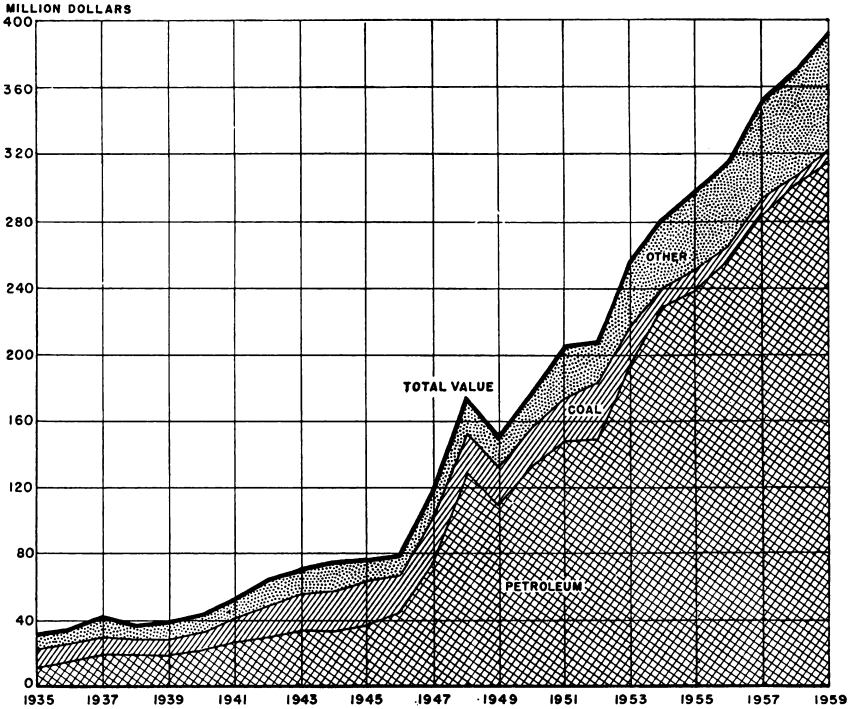

FIGURE 1.—Value of petroleum, coal, and other minerals, and total value of all minerals produced in Wyoming, 1935–59.

In the metals group, decreased production was recorded for iron ore (owing to the steel strike), but uranium-ore production gained, and the value of output rose to $17.6 million, 33 percent more than in 1958. Production of beryl dropped substantially, and there was no recorded output of copper, gold, or vanadium. Value of metals produced in 1959 rose to $20.5 million, compared with $17.3 million in 1958.

The new bentonite mill of Archer-Daniels-Midland Co. and the plant expansion at Westvaco by Intermountain Chemical Co., both begun in 1958, were completed in 1959. Plant capacity at Westvaco was increased to 470,000 tons of soda ash annually. Big Horn Gypsum Co. announced plans to construct a wallboard plant at Cody. The development of Shirley basin uranium deposits continued throughout the year. The Wyoming reserve of uranium rose to 15.8 million tons averaging 0.34 percent U_3O_8 as of December 31, 1959, compared with 11.5 million tons containing 0.31 percent U_3O_8 established December 31, 1958. Development of the low-grade iron-ore deposits near Atlantic City continued by Columbia-Geneva Steel Division of United States Steel Corp.

Employment and Injuries.—According to the Employment Security Commission of Wyoming, the average employment in mining was 9,300, 7 percent above 1958. Employment in the crude-petroleum and natural-gas industry rose 5 percent in 1959, but the continued decline of men working in bituminous and other soft-coal mining partially offset these gains in the petroleum industry.

The State mine inspector reported[2] four fatalities in the noncoal mining industry. There were 3 nonfatal accidents in coal-mining operations and 56 in other mining activities.

TABLE 2.—Mining employment in Wyoming, in thousands

[Bureau of Labor Statistics, U.S. Department of Labor and Employment Security Commission of Wyoming]

	1955	1956	1957	1958	1959
Mining	8.9	8.7	8.5	8.7	9.3
Bituminous and other soft coal	.9	.7	.7	.5	.4
Crude petroleum and natural gas	6.7	6.5	6.2	6.4	6.7
Other	1.3	1.5	1.6	1.8	2.2

Government Programs.—No Office of Minerals Exploration (OME) contracts were executed in 1959.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Production of coal, natural gas, natural-gas liquids, and crude petroleum was valued at $340.2 million, a gain of 6 percent over the preceding year, and represented 87 percent of the value of all mineral production in the State.

Coal.—Coal production from 19 active mines (11 underground, 8 strip) in 8 counties was 21 percent greater than in 1958. Gains were recorded in all producing counties except Lincoln and Sweetwater. The major increase was in Converse County, where the Dave Johnston strip mine operated the entire year. The mine supplied fuel for the Dave Johnston powerplant at Glenrock 18 miles to the south. Plans to build a $3 to $4 million coke plant 6 miles south of Kemmerer were announced by Westvaco Chemical Division of Food Machinery and Chemical Corp. The coke, to be produced by a new process, would use coal from deposits near the plant and would be utilized in the corporation's phosphorous furnaces at Pocatello, Idaho. Construction of the coke plant was to begin early in 1960 with completion expected by August or September. Utah Power and Light Co. continued its plan to build a 150-megawatt steam powerplant, and Pacific Power & Light Co. began the construction of a second 100-megawatt unit at its Dave Johnston plant at Glenrock.

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[2] Duzik, Michael J., Annual Report of the State Inspector of Mines of Wyoming, Year Ending Dec. 31, 1959: 50 pp.

TABLE 3.—Production of coal, by counties

(Exclusive of mines producing less than 1,000 tons annually)

County	1958		1959	
	Short tons	Average value per ton [1]	Short tons	Average value per ton [1]
Campbell	375,947	$1.28	426,609	$1.27
Carbon	97,214	6.61	98,307	3.18
Converse	35,040	3.34	471,506	3.32
Fremont	1,477	5.73	1,902	6.01
Hot Springs	10,683	9.04	14,789	8.36
Lincoln	442,214	2.87	313,146	3.08
Sheridan	369,341	3.39	385,923	3.36
Sweetwater	297,514	6.57	264,626	7.00
Total	1,629,430	3.57	1,976,808	3.37

[1] Value received or charged for coal f.o.b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

Natural Gas.—Natural gas from fields in Lincoln, Sweetwater, Sublette, and Uinta Counties, and residual gas from natural-gas plants marketed through pipelines to consumers in northwestern and West Coast States increased slightly over 1958. Plans for the "Utah Project" advanced toward the construction stage pending approval by the Federal Power Commission. The project would provide a west-coast outlet for southwestern Wyoming gas and would include major pipeline construction by El Paso Natural Gas Co. and Colorado Interstate Gas Co. Additional gathering facilities would be built by Pacific Northwest Pipeline Corp.

Natural-Gas Liquids.—Natural gasoline, butane, and propane were recovered at 16 natural-gas plants in 13 counties. Combined daily capacity of all plants was approximately 640 million cubic feet of gas. At yearend daily throughput was 386 million cubic feet of gas and daily recovery of natural-gas liquids was in excess of 500,000 gallons. Residual gas was marketed through pipelines to consumers. Plans were announced to build a natural-gas plant in the Donkey Creek and Coyote Creek areas in Campbell County. The proposed plant would be an absorption refrigeration system and would process 7 million cubic feet of gas daily. The announcement also indicated that the plant would be designed for iso-butane separation, one of the few such systems in the Rocky Mountain region.

Petroleum.—Petroleum production from 200 fields in 20 of the State's 23 counties was 126 million barrels, an increase of 10.4 million barrels, or 9 percent over that of 1958. The $314.9 million value of 1959 output represented 80 percent of the value of all mineral production in the State. Exploration drilling resulted in 21 oil discoveries and 22 gas discoveries from 375 completed wells, a success ratio of 11.5 percent, and the third best year in State history. There were more discoveries in 1954 and 1957 and more total drilling in 1954 and 1956. Of 615 development wells completed in 1959, 350 were oil producers and 55 gas, a success ratio of 65.8 percent.

Discoveries were in the Green River (4 oil, 18 gas), Powder River (13 oil, 1 gas), Wind River (3 oil, 3 gas), and the Big Horn (1 oil) basins. Development drilling was most active in the Powder River basin with 180 successful wells (179 oil, 1 gas), followed by the Big Horn basin with 96 (93 oil, 3 gas), the Green River basin with 83 (36 oil, 47 gas), and the Wind River basin with 46 (42 oil, 4 gas). A unitization program, believed to be the largest ever undertaken, was begun in the Green River basin by Green River Basin Corp. of Chicago, which owned 61.8 percent of the 205,000 acres involved. The object of the unitization was to coordinate exploration activities in the area that is featured geologically by stratigraphic traps. The project had the approval of both Federal and State agencies. The nine oil refineries in the State operated the entire year. Throughput was 37.1 million barrels of crude oil, a gain of 8.5 percent over the previous year. Batzer Oil Co. sold its refinery at Lovell to Husky Oil Co. of Cody. The plant was being dismantled and the equipment was to be used for expansion of the Husky plant at Cody, where a major modernization program was started. The program was to include new catalytic cracking and alkylation units and increase the daily capacity of the refinery from 7,000 to 9,000 barrels of oil a day. Texaco, Inc., planned the installation of a 4,500-barrel-per-day gas-oil hydrotreater at its refinery at Casper. Completion of the installation was expected late in 1960. Mountain Fuel Supply Co. built a 24-mile, 20-inch gas pipeline from Yellow Creek to Coalville, Utah, and laid 7 miles of 6- and 8-inch gas pipeline near Rock Springs. The Wyoming Public Service Commission approved construction by Teton Pipeline Co. of an 8-mile, 5-inch crude-oil pipeline to connect the O'Brien Springs field in Carbon County with the Sinclair pipeline system. The installation would also include 2,000 barrels of storage facilities. Honolulu Oil Co. began constructing a 30-mile, 6-, 8-, and 10-inch pipeline from the Fourbear field in the Big Horn basin to the Oregon basin station of Platte Pipe Line Co. The high gravity (13°) crude would be heated three times (from 45° to 190° F.) over the 30-mile distance to facilitate operation of the line during cold weather.

TABLE 4.—Production of crude petroleum, by counties

(Thousand barrels)

County	1958	1959 (preliminary)	Principal fields in 1959 in order of production
Albany	397	365	Quealy.
Big Horn	12,142	11,386	Garland, Bonanza, Byron.
Campbell	877	966	Dead Horse Creek, Barber Creek.
Carbon	3,441	10,216	Big Medicine Bow, Wertz.
Converse	5,146	4,874	Glenrock, Big Muddy.
Crook	1,342	3,058	Donkey Creek, Robinson Ranch, Coyote Creek.
Fremont	14,769	13,372	Winkleman Dome, Steamboat Butte, Big Sand Draw, Beaver Creek.
Goshen	47	30	Torrington.
Hot Springs	14,845	20,719	Hamilton Dome, Grass Creek, Murphy Dome, Black Mountain, Little Buffalo Basin.
Johnson	7,046	7,729	Sussex, North Fork, Meadow Creek, Meadow Creek-N.
Laramie	461	336	Horse Creek.
Lincoln	89	----------	
Natrona	11,909	12,068	Salt Creek, Grieve Unit, Salt Creek-E.
Niobrara	1,553	1,212	Lance Creek, Lance Creek-E, Little Buck Creek.
Park	26,749	28,007	Elk Basin, Oregon Basin.
Sheridan	995	875	Ash Creek.
Sublette	632	663	Big Piney.
Sweetwater	4,089	3,592	Lost Soldier.
Uinta	45	74	Church Buttes.
Washakie	5,869	3,601	Cottonwood Creek.
Weston	3,129	2,825	Clareton, Fiddler Creek, Skull Creek.
Total	115,572	125,968	

TABLE 5.—Wildcat- and development-well completions in 1959, by counties

[The Oil and Gas Journal]

County	Crude	Gas	Dry	Service	Total	Footage
WILDCAT						
Albany			5		5	18,300
Big Horn			13		13	36,600
Campbell	2		34		36	274,800
Carbon		2	16		18	100,000
Converse	[1] 1		3		4	27,300
Crook	4		31		35	157,900
Fremont	1	2	26		29	158,100
Goshen			2		2	8,500
Hot Springs			11		11	55,100
Johnson	3		9		12	59,800
Laramie			9		9	66,600
Lincoln	1	4	12		17	131,300
Natrona	2	1	27		30	133,300
Niobrara	2		15		17	81,300
Park	1		10		11	54,800
Platte			7		7	11,300
Sheridan			4		4	32,000
Sublette		7	13		20	125,100
Sweetwater	3	5	34		42	299,400
Teton			2		2	4,700
Uinta			4		4	16,200
Washakie			7		7	47,100
Weston	2		38		40	232,600
Total	[1] 22	21	332		375	2,132,100
DEVELOPMENT						
Big Horn	18		8		26	107,100
Campbell	15		5		20	141,400
Carbon	10	1	8		19	78,900
Converse	14		3		17	78,200
Crook	52		19		71	362,400
Fremont	14		11		25	95,000
Hot Springs	31			9	40	138,800
Johnson	30		9	5	44	264,000
Laramie			1		1	7,800
Lincoln		8	3		11	76,800
Natrona	[1] 30	2	25		57	209,900
Niobrara	1	1	12		14	44,500
Park	36	3	7	1	47	224,900
Sublette	22	32	10		64	318,000
Sweetwater	4	6	5		15	94,000
Washakie	8		5		13	65,700
Weston	67		38	26	131	459,300
Total	[1] 352	53	169	41	615	2,766,700
Grand total	[2] 374	74	501	41	990	4,898,800

[1] Includes 1 condensate-well completion.
[2] Includes 2 condensate-well completions (1 wildcat, 1 development).

The Federal Bureau of Mines petroleum center at Laramie continued its studies on petroleum production, petroleum processing and utilization, and oil shale. Production and secondary-recovery research concerned variation of the physical characteristics of petroleum reservoir fluids within geological basins and determination of the types and amounts of clay minerals in reservoir rocks and their effects on the behavior and water sensitivity of the rocks. Processing and utilization research included analysis of newly discovered crude oils from the Rocky Mountain States and compositional studies of sulfur and nitrogen compounds found in petroleum.

Research on oil shale and shale oil included studies of the composition and properties of oil shale, analyses of shale oil and its fractions, studies of thermal reactions of shale-oil components, and research on new methods for converting shale organic matter to oil, such as by irradiation and the action of microorganisms. A study was initiated on the application of depleted uranium catalysts in hydrogenating and reforming shale oil and its fractions. Responsibility for petroleum research in Alaska was assigned to the Center.

Reports[3] of the results of pilot plant processing of oil shale conducted at the Rifle, Colo., oil shale project and other research work were published.

NONMETALS

Cement.—Shipments from the Monolith Portland Midwest Co.'s Laramie plant, the only producer of cement in the State, fell 3 percent below 1958, the first such decline in many years. The company's one kiln operated 345 days, utilizing cement rock and sandstone mined by the company and limestone produced by a contractor. Shipments of cement were made to consumers in Wyoming, Colorado, Nebraska, and New Mexico

Clays.—A decrease in the output of miscellaneous clay used in manufacturing cement caused a substantial reduction in total clay production in Wyoming. Wyoming continued to be the leading source of bentonite in the United States; output reached 763,800 tons, 9 percent above 1958. Apparent increases in the demand for bentonite for use at foundries and steel works, chemicals, and in oil-well drilling mud were responsible for the production gain. The Archer-Daniels-Midland Co. completed the construction of its bentonite plant at Upton during 1959; the dryer section of the old mill had been destroyed by fire October 24, 1958. The new plant has a capacity of 450 tons of bentonite per day. Wyo-Ben Products Co. reported installation of an 8- by 64-foot dryer, which had a designed annual capacity of 250,000 tons of bentonite. Lovell Clay Products Co. mined fire clay, and Sheridan Press Brick & Tile Co. mined miscellaneous clay for use in manufacturing building brick and other heavy clay products. Great Western Aggregates, Inc., operated its Laramie lightweight aggregate plant using shale mined from nearby pits.

Feldspar.—No feldspar from Wyoming pegmatites was shipped during 1959.

Gem Stones.—The collection of gem and ornamental stones in Wyoming continued to be of interest to many individuals, societies, and dealers. The estimated value ($76,000) of the material mined or collected was based on reports received from persons engaged in securing and processing this material. The value was 46 percent greater than in 1958, and, in terms of value, Wyoming ranked seventh in the United States. Fremont County was credited with the highest value of stones collected; jade was predominant. Sweetwater was the second leading producing county with agate and petrified wood the principal gem-stone materials.

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[3] Carpenter, H. C., and Cottingham, P. L., Evaluation of Catalysts for Hydrogenating Shale Oil: Bureau of Mines Rept. of Investigations 5533, 1959, 29 pp.
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Zaffarano, R. F., Cupps, C. Q., and Fry, J., Reservoir-Oil Characteristics, Aneth Field, San Juan County, Utah: Bureau of Mines Rept. of Investigations 5511, 1959, 51 pp.

Gypsum.—The only crude gypsum came from a pit near Woods Landing operated by Wyoming Construction Co. The 8,700 tons of crude material was used as a retarder in cement manufacturing. Big Horn Gypsum Co. announced plans for constructing a wallboard plant at Cody, Park County. Reportedly, the company had leased a gypsum deposit 4½ miles south of Cody.

Mica.—Nicola & Harvey reported shipment of a small quantity of hand-cobbed sheet mica from Spook Lode No. 3 near Guernsey to the Government purchase depot at Custer, S. Dak.

Phosphate Rock.—Continued development of phosphate rock deposits in the Leefe area near Sage resulted in a substantial increase in production. San Francisco Chemical Co. operated its 1,000-ton-a-day flotation plant throughout the year utilizing both Wyoming ore and material mined from company-owned Utah deposits. Manufacturers of ordinary superphosphate consumed the bulk of the output, but triplesuperphosphate and phosphoric acid also were produced.

Pumice.—Scoria shipments totaled 94,000 tons, compared with 45,000 tons in 1958. Increased demand for railroad ballast, the principal use of Wyoming scoria, accounted for the significant increase.

Sand and Gravel.—A 1.1-million-ton drop in the production of paving sand and gravel was partly offset by a 364,500-ton increase in building sand and gravel, but the decrease in paving aggregate was significant enough to cause an overall 641,000-ton (12 percent) decline in total sand and gravel output. Production by Government-and-contractor producers in 11 counties was recorded at 2.6 million tons valued at $2.3 million; commercial producers reported an output of 2 million tons valued at $1.7 million from 14 counties. Seventy-seven percent of the Government-and-contractor and 59 percent of the commercial output was washed, crushed, screened, or otherwise prepared. Wyoming ranked sixth in the Nation in mileage (138 miles) of construction underway on the Federal Interstate Highway System.[4] In all mileage completed since July 1, 1956, to date, Wyoming ranked 16th with 161.4 miles.

TABLE 6.—Production of sand and gravel in 1959, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Albany	209	$112	Platte	(1)	(1)
Carbon	59	21	Sheridan	83	$159
Converse	10	5	Sweetwater	(1)	(1)
Fremont	595	442	Teton	2	2
Goshen	34	23	Uinta	28	43
Hot Springs	13	22	Washakie	57	50
Johnson	6	4	Weston	2	1
Laramie	325	371	Yellowstone National Park	(1)	(1)
Lincoln	53	70	Undistributed	2,279	1,960
Natrona	773	575			
Park	164	122	Total	4,692	3,982

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

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[4] Bureau of Public Roads, Status of Federal-Aid Highway Programs, December 1959; Press release BPR 60-8.

TABLE 7.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1958		1959	
	Quantity	Value	Quantity	Value
COMMERCIAL OPERATIONS				
Sand:				
Building	278	$205	151	$220
Paving	57	65	225	138
Blast	3	4		
Fill	34	25	(1)	(1)
Other	(2)	(2)	36	27
Total	372	299	412	385
Gravel:				
Building	221	256	285	384
Paving	878	661	1,124	774
Railroad ballast	133	66	189	95
Fill	(1)	(1)	(1)	(1)
Other	29	28	46	35
Total	1,261	1,011	1,644	1,288
Total sand and gravel	1,633	1,310	2,056	1,673
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	13	16	95	95
Paving	7	7	98	102
Total	20	23	193	197
Gravel:				
Building	49	33	394	299
Paving	3,631	3,394	2,049	1,813
Total	3,680	3,427	2,443	2,112
Total sand and gravel	3,700	3,450	2,636	2,309
ALL OPERATIONS				
Sand	392	322	605	582
Gravel	4,941	4,438	4,087	3,400
Total	5,333	4,760	4,692	3,982

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Other".
[2] Less than 1,000 tons.

Sodium Carbonate and Sulfate.—Intermountain Chemical Co. continued to be the only producer of trona in Wyoming. According to the Annual Report of the State Inspector of Mines of Wyoming, Intermountain mined 805,406 tons of trona during the year from which 444,284 tons of soda ash was produced. The company completed a plant-expansion program, which increased annual soda-ash capacity to 470,000 tons. Improvements at the mine included the purchase of two continuous mining machines, two ore skips, and two shuttle cars. Ninety-five percent of the soda ash shipped from Westvaco was by rail; the remaining 5 percent was transported by truck. A description of the mining methods in use at Westvaco was published.[5]

Exploration for trona deposits in Wyoming reached substantial proportions. Some 2,000 square miles in the Green River area was explored by various chemical firms seeking commercial deposits. The principal companies prospecting the area were Diamond Alkali Co.; Stauffer Chemical Corp., an affiliate of Ruby Chemical Corp. of California; and J. R. Simplot Co.

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[5] Mining World, How Pillars Are Robbed At Westvaco: Vol. 21, No. 6, May 1959, pp. 44–46.

Sodium sulfate deposits near Rawlins and Casper were mined by Sweetwater Chemical Co. and William E. Pratt, respectively.

Stone.—Once again the production of limestone dominated the stone industry in Wyoming. The use of limestone and cement rock for cement manufacturing increased, resulting in a gain of 36 percent in the output of limestone. However, a 31-percent drop in the production of noncommercial granite, limestone, and miscellaneous stone, mined mainly for reclamation and roadbuilding, kept the overall stone output for the State to a 20-percent increase in 1959. Guernsey Stone Co., The Great Western Sugar Co., and Monolith Portland Midwest Co. were among the largest producers in terms of tonnage and all three companies quarried limestone. DeWald Stone Works in Albany County produced 3,750 cubic feet of dressed building granite and 5,300 tons of dressed building sandstone. Morrison-Knudsen Co., Inc., quarried 210,700 tons of crushed granite which was used as riprap, railroad ballast, and for roads. Construction crews of the Wyoming State Highway Department mined 17,900 tons of crushed granite and a large quantity of crushed limestone.

TABLE 8.—Production of stone in 1959, by counties

County	Short tons	Value	County	Short tons	Value
Albany	(1)	(1)	Platte	(1)	(1)
Fremont	200	$200	Teton	22,100	$22,100
Goshen	800	1,200	Undistributed	842,913	1,039,590
Laramie	439,400	710,100			
Natrona	12,000	18,000	Total	1,317,413	1,791,190

[1] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Sulfur.—Production of elemental sulfur from sour natural gas was at about the same level as that reported in 1958 (117,000). However, as a result of increased demand, shipments were 50 percent above 1958. Because of a drop in the average price of sulfur, as reported by producers ($19.70 in 1959, compared with $24.77 in 1958), the value of shipments was only 19 percent over 1958.

Jefferson Lake Sulphur Co. operated its Manderson works (Big Horn County), but reportedly planned to shut down this facility in mid-1960. Pan American Petroleum Corp. recovered sulfur at its Elk Basin (Park County) and Cottonwood Creek (Washakie County) plants. Texaco Seaboard, Inc. (at Silvertip, Park County) and Texas Gulf Sulphur Co. (at Worland, Washakie County) also produced sulfur.

Vermiculite.—Golden-Earth, Inc., mined no vermiculite in 1959.

METALS

Beryllium.—Production of beryl from the Sleeper Nos. 1 and 2 claims of Thermopolis Mining & Exploration Co. was reduced sharply, and Wyoming output fell to only 1 ton of beryl, compared with 17 tons in 1958. Beryl crystals also were covered from the Holy Terror

Lode by Sam Lohr and Pete Mark, and from the Casper Mountain pegmatite by James W. Strait. All beryl produced was shipped to the Government purchase depot at Custer, S. Dak.

Gold, Silver, and Copper.—There was no recorded production of these metals during 1959.

Iron Ore.—Shipment of iron ore decreased 10 percent, owing to nonproduction from the Sunrise mine of The Colorado Fuel and Iron Corp. during most of July and all of August, September, and October because of the nationwide strike, which idled the company's Pueblo (Colo.) steel plant. Mining operations were resumed at the Sunrise mine in November when the Pueblo plant was reactivated under provisions of the Taft-Hartley Labor Relations Act. Sunrise mine was again the major producer.

Columbia-Geneva Steel Division of the United States Steel Corp. continued development work on its low-grade iron-ore deposits near Atlantic City in Fremont County. The division purchased 1,200 acres of placer claims from Wyoming Mica and Metals, Inc., of Lander, on which to build a reservoir for its mining operation. Personnel of the Union Pacific Railroad surveyed the right-of-way for a 75-mile spur line which would be used to haul ore from the property to the main line of the Union Pacific. According to the United States Steel Corp. annual report for 1959, engineering designs were substantially completed for facilities to produce high-grade iron-ore concentrate from the taconite-type deposits, although the construction of production capacity at this location had not been authorized.

Southwestern Engineering Co. sold the agglomerates produced from the testing of ore mined and shipped in 1958 from the Shanton mine near Bosler in Albany County to the Combined Metals Reduction Co. Krupp-Renn pilot plant at Caselton, Nev. The agglomerates, marketed in 1959, were recorded as production in that year. Magnetite Products Corp. shipped a minor quantity of iron ore (magnetite) from the Cobar No. 1 mine in Albany County for use as aggregate in concrete for coating underwater pipelines and transmission lines.

Uranium.—Production of uranium ore from 111 operations in 10 counties increased 33 percent compared with 1958. Fremont, Natrona, and Crook Counties continued to be the leading producers and accounted for 96 percent of all uranium ore produced in the State. Development of ore bodies in the Shirley basin in Fremont and Natrona Counties aroused considerable interest. These ore bodies are of substantially higher grade than Gas Hills ore but are several hundred feet below the surface. Because of the depth of the ore bodies, shafts are required for development, and several were being sunk at the end of the year. The average grade of ore produced in the State was 0.25 percent (5 pounds per ton) uranium oxide, the same as in 1958. The reserve of uranium ore as of December 31, 1959, determined by the Atomic Energy Commission (AEC), was 15.8 million tons containing 0.34 percent (6.8 pounds per ton) uranium oxide compared with 11.5 million tons containing 0.31 percent (5.2 pounds per ton) uranium oxide as of December 31, 1958.

Processing mills at Jeffrey City (Split Rock), Gas Hills, and Riverton operated the entire year. Ore-processing capacity was increased at two existing plants, and two new ones were built under uranium purchase contracts with AEC.

TABLE 9.—Mine production of uranium ore, by counties[1]

County	1958				1959			
	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]	Number of operations	Ore (short tons)	U_3O_8 contained (pounds)	F.o.b. mine value[2]
Big Horn	6	6,313	39,459	$169,117	6	3,529	18,928	$78,250
Campbell	32	4,449	24,572	100,452	17	3,366	15,730	61,463
Carbon	3	(3)	(3)	(3)	5	2,405	9,320	36,786
Converse	23	33,746	163,606	673,968	19	27,148	113,795	445,887
Crook	9	9,899	42,514	163,411	15	44,957	198,332	788,930
Fremont	57	594,150	3,000,208	12,134,229	36	732,304	3,858,510	15,894,501
Johnson	6	339	1,445	5,754	4	481	2,376	9,456
Natrona	5	1,783	5,260	15,841	7	50,068	119,525	291,602
Niobrara	4	(3)	(3)	(3)	--------	--------	--------	--------
Sublette	--------	--------	--------	--------	1	(3)	(3)	(3)
Sweetwater	--------	--------	--------	--------	1	(3)	(3)	(3)
Undistributed	--------	1,111	5,634	22,862	--------	324	917	2,671
Total	145	651,790	3,282,698	13,285,634	111	864,582	4,337,433	17,609,546

[1] Based on data supplied to Bureau of Mines by AEC.

[2] F.o.b. mine value, base price, grade premiums, and exploration allowance.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

The concentrate-purchase contract between AEC and Western Nuclear, Inc., as amended and extended on February 27, provided for an increase in daily capacity of the mill at Split Rock from 400 to 845 tons and extended the purchase agreement to December 31, 1966. Western Nuclear, Inc., (formerly Lost Creek Oil & Uranium Co.) had built the first processing mill in Wyoming and delivered the first shipment of uranium oxide to AEC in August 1957.

The purchase contract between AEC and Lucky Mc Uranium Corp., amended and approved on May 1, raised the daily capacity of the plant from 833 to 980 tons and extended the expiration date to December 31, 1966. The new agreement also provided a firm market for a number of independent operations by "dedicating" their ores to the mill on the basis of allocations. The first shipment of uranium oxide by the Lucky Mc mill to AEC was in March 1958.

A uranium purchase contract between AEC and Federal-Radorock-Gas Hills Partners was approved April 10 and will expire on December 31, 1966. The contract provides for the purchase of uranium concentrate produced at a new mill of 522 tons daily capacity, to be built in the Gas Hills area about 50 miles east of Riverton in Fremont County. Construction of the plant was begun in April and was completed in October. The first shipment of uranium oxide was delivered to AEC in December. The contract also provided for the commitment to the mill of ores from a number of independent operators. Federal-Radorock-Gas Hills was a partnership comprised of Federal Uranium Corp., Radorock Resources, Inc., and Gas Hills Uranium Co., with Federal Uranium Corp, as the general manager of the partnership. All had substantial holdings in the Gas Hills area.

On May 13, AEC approved a uranium-concentrate purchase contract with Globe Mining Co., a wholly-owned subsidiary of Union Carbide Corp., which operated through its division, Union Carbide

Nuclear Co. The contract, which will terminate December 31, 1966, provided for the construction of a 492-ton-per-day plant in the eastern Gas Hills in Natrona County. Crude ore for the mill would come from properties controlled by Globe Mining Co. and committed to the mill. AEC reserved the option to request that the mill treat ores from other operators if necessary. Construction of the mill, begun in May, was completed in December. Operations were begun but no concentrate had been delivered at yearend. Susquehanna Western, Inc., operating a 500-ton-per-day custom uranium mill at Riverton, doubled the capacity of its sulfuric acid plant to 200 tons a day and will be able to provide sulfuric acid for all Wyoming uranium mills as well as other consumers.

REVIEW BY COUNTIES

Albany.—Laramie was again the center of nonmetal mineral-industry activity in Albany County. Monolith Portland Midwest Co. operated its cement plant throughout the year and accounted for nearly all stone quarried. Great Western Aggregates, Inc., produced lightweight aggregate from shale mined from nearby pits in a plant adjacent to the Monolith cement plant. Wyoming Construction Co. quarried gypsum for use as a cement retarder; output was 40 percent greater than in 1958.

Petroleum production from four fields declined slightly from 1958. Ohio Oil Co. operated its McFadden natural-gas absorption plant at Rock River. Throughput averaged 1.6 million cubic feet per day, and recovery of natural-gas liquids averaged 7,000 gallons per day. Residual gas was marketed through Colorado Interstate Gas Co. pipelines to consumers.

Big Horn.—Petroleum production of 11.4 million barrels from 17 fields represented 90 percent of the total value of all mineral output in the county. Thirteen exploratory wells were failures, but 18 of 26 development wells completed were oil producers. Mobil Producing Co. operated its natural-gas plant at Manderson. Throughput of the plant averaged 7 million cubic feet of gas a day with the recovery of 1,600 gallons of natural-gas liquids per day. The residual gas was further processed by Jefferson Lake Sulphur Co. for the recovery of elemental sulfur and then marketed through pipelines of Montana Dakota Utilities Co. to consumers.

TABLE 10.—Value of mineral production in Wyoming, by counties

County	1958	1959 [1]	Minerals produced in 1959 in order of value
Albany [2]	$6,143,658	$5,494,840	Cement, petroleum, stone, iron ore, clays, sand and gravel, gypsum, gem stones.
Big Horn [3]	34,693,607	31,623,995	Petroleum, clays, uranium ore, gem stones.
Campbell	[4] 2,871,099	3,017,937	Petroleum, coal, uranium ore.
Carbon [5]	9,667,780	[6] 25,935,667	Petroleum, coal, uranium ore, sodium sulfate, sand and gravel, gem stones.
Converse	14,225,889	[7] 14,201,705	Petroleum, coal, uranium ore, sand and gravel, gem stones.
Crook	8,711,500	13,071,810	Petroleum, clays, uranium ore.
Fremont [7]	51,165,548	49,811,804	Petroleum, uranium ore, sand and gravel, gem stones, coal, stone, beryllium concentrate.
Goshen	133,698	100,643	Petroleum, sand and gravel, stone, gem stones, mica (sheet), beryllium concentrate.
Hot Springs [5]	38,907,931	51,943,453	Petroleum, coal, sand and gravel.
Johnson [5]	(8)	[6] 19,374,206	Petroleum, clays, uranium ore, sand and gravel.
Laramie	(8)	1,921,500	Petroleum, stone, sand and gravel.
Lincoln	2,496,580	(7, 8)	Phosphate rock, coal, sand and gravel, gem stones.
Natrona [7]	31,507,581	31,309,663	Petroleum, sand and gravel, uranium ore clays, sodium sulfate, stone, gem stones beryllium concentrate.
Niobrara [6]	(5, 8)	3,030,000	Petroleum.
Park [3]	69,922,070	70,139,700	Petroleum, sand and gravel.
Platte	4,089,596	3,375,313	Iron ore, stone, sand and gravel, gem stones.
Sheridan	3,950,401	3,722,066	Petroleum, coal, sand and gravel, pumice, clays.
Sublette [5]	1,649,520	(8)	Petroleum, uranium ore.
Sweetwater [7]	21,634,367	21,655,180	Sodium carbonate, petroleum, coal, sand and gravel, gem stones, uranium ore.
Teton	35,435	24,100	Stone sand and gravel.
Uinta [6]	117,450	[5] 227,650	Petroleum, sand and gravel, gem stones.
Washakie [3]	(8)	9,052,500	Petroleum, sand and gravel.
Weston [6]	9,728,255	8,548,263	Petroleum, clays, sand and gravel.
Yellowstone National Park	96,700	(8)	Sand and gravel.
Undistributed [9]	58,908,314	24,570,478	
Total [10]	369,938,000	391,621,000	

[1] Preliminary values of natural gas and petroleum.
[2] Excludes natural-gas liquids and sulfur.
[3] Excludes natural gas, natural-gas liquids, and sulfur.
[4] Excludes vanadium.
[5] Excludes natural gas.
[6] Excludes natural-gas liquids.
[7] Excludes natural gas and natural-gas liquids.
[8] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[9] Includes all natural gas, natural-gas liquids, vanadium (1958) and some sand and gravel, stone, gem stones, beryllium concentrate (1958), and values indicated by footnote 8.
[10] Total adjusted to eliminate duplicating the value of raw materials used in manufacturing cement.

Uranium ore produced at six operations by Lisbon Uranium Corp. and Great Western Oil Co. was shipped to the processing plant at Riverton for treatment.

The county continued to rank second in output of bentonite. Magnet Cove Barium Corp. was the leading producer in the county and State with mines and mill near Greybull. Wyo-Ben Products Co. also produced and milled bentonite north of the Magnet Cove operation. Lovell Clay Products Co. quarried miscellaneous clay or shale for use at its Lovell brick plant.

Campbell.—Petroleum production from five fields, principally Dead Horse Creek and Barber Creek, increased 10 percent, compared with 1958, and represented 80 percent of the total value of all mineral output in the county. Of 36 exploratory wells completed, 2 were successful. Rozet field, completed in April, pumped 202 barrels of oil a day from the Muddy formation, and the Timber Creek field, discovered in December, pumped 60 barrels of oil a day from the Minnelusa formation. Development drilling resulted in 15 oil wells, 6 of them in the Rozet field, from 20 completions. Coal production from the Wyodak strip mine operated by Wyodak Resources Development Corp. increased 13 percent, compared with 1958. A major proportion of the output was used at powerplants in eastern Wyoming and western South Dakota.

Uranium ore produced at 17 operations was shipped to mills in Wyoming, South Dakota, and Colorado for treatment. Major producers were Powder River Mines, Inc., from Jake Nos. 1 and 3; Western Uranium Corp. from the Doe No. 1 and Sue No. 3; and North Central Mining Co. from Alma No. 8 and Nero No. 5 mines. These three operators accounted for 83 percent of all uranium ore in the county.

Carbon.—Petroleum output from 15 fields increased threefold over 1958 and represented 98 percent of the total value of all mineral production in the county. Major producing fields were Big Medicine Bow with 6.6 million barrels and Wertz with 2.1 million barrels. Late in the year, a gas-discovery well in the Cherokee Creek area was completed and flowed 887,000 cubic feet a day from the Deep Creek formation. Of 19 development wells completed, 10 were oil wells and 1 a gas well. Sinclair Refining Co. operated its 25,000-barrel-per-day refinery at Sinclair with throughput slightly below that of 1958. Coal production from three mines, two strip and one underground, was slightly above that of 1958. Monolith Portland Midwest Co. operated the Hanna No. 2 strip mine for use at its cement plant at Laramie. Hanna Basin Construction & Coal Co. operated the Nugget strip and Mike & Harry Thomas operated the Thomas underground mine.

Uranium ore produced at five operations was shipped to mills at Riverton and Maybell, Colo., for treatment. Basin Engineering Co., operating the Lucky Strike, Teton, and Teton No. 3 mines, was the major producer.

Converse.—Petroleum output from seven fields declined 5 percent compared with 1958 and represented 86 percent of the total value of all mineral production in the county. Major producing fields were Glenrock with 2.9 million barrels and Big Muddy with 1.6 million barrels. One gasfield was discovered from four exploratory wells completed. Initial production from the discovery well was 2.5 million cubic feet a day from the Mesaverde formation. Cabot Carbon Co. completed construction of its refrigeration process natural-gasoline plant at Glenrock designed to process 9 million cubic feet of gas a day. Average throughput was 6.5 million cubic feet with the recovery of 43,000 gallons of natural-gas liquids. Coal production from two strip mines increased substantially over that of 1958. A full year's operation of the Dave Johnston strip mine 15 miles north of Glenrock for use at the 100-megawatt Dave Johnston powerplant, operated by Pacific Power & Light Co. at Glenrock, accounted for the increase. During the year the company began construction of a second 100-megawatt unit at the plant with completion scheduled for 1960.

Uranium-ore production from 19 operations declined 20 percent, compared with 1958. Major producers were B & H Mines operating the Betty Lou Nos. 20 and 21 mines, and Vernon A. Mrak operating the Pat group and Pit mines. The entire output was processed at mills in Wyoming and South Dakota.

Crook.—Petroleum production from six fields was more than double that of 1958. Major producing fields were Donkey Creek with 1.8 million barrels, and Robinson Ranch and Coyote Creek with more than 500,000 barrels each. Of 35 exploratory wells completed, the most significant was the discovery well for the Prong Creek field in November. Initial production of the discovery well was 500 barrels a day on pump from the Minnelusa formation. The field was 7 miles northeast of the Donkey Creek field and 6 miles northwest of the Robinson Ranch field. A second important discovery was at the Miller Creek field completed in June. The discovery well pumped 231 barrels of oil a day from the Dakota formation. Of 71 development wells completed, 52 were oil producers. The major portion of the development was in the Coyote Creek field, a 1958 discovery, where 38 new producers were completed in 1959, at the Robinson Ranch field where 9 new producers were added, and at the Donkey Creek field with 4 new producers.

Uranium ore produced at 15 operations was four times greater than that of 1958. The entire output was shipped to the mill at Edgemont, S. Dak., for treatment. The major producer was the Homestake Mining Co. at the New Haven group of mines.

Bentonite produced in the county was second only to petroleum in terms of value, and the county was the major source of this type of clay. Mining operations were conducted by American Colloid Co., Archer-Daniels-Midland Co., Black Hills Bentonite Co., International Minerals & Chemical Corp., and National Lead Co. Crude material was milled by Archer-Daniels-Midland Co. and National Lead Co. and the remaining raw clay was shipped to milling plants near Belle Fourche, S. Dak.

Fremont.—Petroleum and uranium ore, the major mineral products of the county, together represented 99 percent of the total value of all mineral production. Petroleum production from 21 fields was 9 percent below that of 1958, and the county ranked third in the State in petroleum output. Major producing fields were Winkleman Dome and Steamboat Butte, each with more than 3 million barrels, and Big Sand Draw and Beaver Creek, each with more than 2 million barrels. Three of the six discoveries in the Wind River basin in 1959 were in Fremont County. Rolff Lake-NW field was discovered in February and the discovery well pumped 62 barrels of oil a day from the Dinwoody formation. Two gas discoveries in the Lysite area flowed 21 million cubic feet a day from the Lance formation and 1 million cubic feet a day from the Wind River formation, respectively. Of 25 development wells completed, 14 were oil producers, most in the Winkleman Dome and Lost Cabin fields.

Northern Utilities Co. operated its natural-gasoline plant at the Sand Draw field and Pan American Petroleum Corp. completed its 62-million-cubic-feet-a-day absorption plant at the Beaver Creek field. Residual gas was marketed through pipelines of the Rocky Mountain Gas Co.

The county led the State in the production of uranium ore from 36 operations. Major producers were Lucky Mc Uranium Corp., Western Nuclear, Inc., and Vitro Minerals Corp. These three companies accounted for 79 percent of all uranium ore mined in the county. Total production was 23 percent greater than in 1958. Mills operated by Susquehanna Western, Inc., at Riverton and Lucky Mc Uranium Corp. in the Gas Hills were active the entire year; capacity of the Lucky Mc mill was increased from 833 tons to 920 tons a day. Federal-Radorock-Gas Hills Partners completed its 520-ton-per-day mill 50 miles east of Riverton and began operation in November. Crude ore came from the partner's Sagebrush mine and from independent operations. Globe Mining Co. continued development at the Dick Nos. 1, 7, and 9 mines preparatory to completion of its 492-ton-per-day processing plant in Natrona County. Production by Western Nuclear, Inc., was from the Frazier-Lamac and Bull Rush group mines and the Loma mine. Vitro Minerals Corp. operated the John No. 2 mine.

Coal production from the George coal mine (underground) was 29 percent greater than in 1958.

Thermopolis Mining & Exploration Co. produced 623 pounds of beryl averaging 12.52 percent BeO from the Sleeper Nos. 1 and 2 claims.

Goshen.—Petroleum production from the Torrington field declined 36 percent compared with 1958. Two exploratory wells, both failures, were completed. Sam Lohr & Pete Mark produced a small quantity of beryl from the Holy Terror Lode. Nicola & Harvey shipped some hand-cobbed mica to the Custer (S. Dak.) Government purchase depot from the Spook Lode No. 3.

Hot Springs.—Hot Springs County was second in the State in petroleum production from 16 fields. Output totaled 20.7 million barrels, a 40-percent increase over 1958. Major producing fields were Hamilton Dome with 6.1 million barrels, Grass Creek with 4.5 million barrels, and Murphy Dome, Black Mountain, and Little Buffalo Basin with more than 2 million barrels each. Eleven exploratory wells, all failures, were completed. Of 40 development wells completed, 31 were oil producers, most in the Grass Creek, Hamilton Dome, and Murphy Dome fields. Empire State Oil Co. operated its 5,000-barrel-per-day refinery at Thermopolis. Throughput was 12 percent below that of 1958. Coal production from three underground mines increased 38 percent over 1958. The major producer was the Roncco Coal Co. at the Roncco mine.

Johnson.—Petroleum production from eight fields was 10 percent greater than in 1958 and represented nearly all value of mineral production in the county. Major producing fields were Sussex with 3 million barrels, North Fork, Meadow Creek, and Meadow Creek-N, all with more than 1 million barrels each. A new oilfield, the Tisdale-SE, was discovered in July. The discovery well pumped 105 barrels of oil a day from the Tensleep formation. A new producing horizon was discovered in November at the Sussex-W field; 20 barrels of oil a day were pumped from the Parkman formation. Of 44 development wells completed, 30 were oil producers, most of them in the

Meadow Creek and Meadow Creek-N fields, where the producing area was extended to the east and northeast. Continental Oil Co. operated its Linch natural-gas refrigeration plant in the Sussex field. Throughput averaged 16.2 million cubic feet a day with the recovery of 30,000 gallons of natural-gas liquids. Residual gas was marketed through pipelines of Montana Dakota Utilities Co.

Uranium ore produced at four operations was shipped to the mill at Edgemont, S. Dak., for processing.

Benton Clay Co. mined bentonite from its Johnson County deposits and shipped the raw clay to its Casper grinding mill.

Laramie.—Petroleum production from four fields—Horse Creek being the major one—was 27 percent below that of 1958. One development well and nine exploratory wells were failures. Frontier Refining Co. operated its 20,000-barrel-per-day refinery at Cheyenne; throughput was 7.1 million barrels, an 8-percent increase over 1958.

Lincoln.—Phosphate rock was the principal product of the county's mineral industry. San Francisco Chemical Co. operated its Leefe mine and flotation mill near Sage; output was 32 percent greater than in 1958.

Natural gas from the LaBarge field was processed in the newly completed El Paso Natural Gas Co. 250-million-cubic-feet-per-day absorption plant at Opal. Throughput averaged 158 million cubic feet a day with the recovery of 130,000 gallons of natural-gas liquids. Residual gas was marketed through pipelines of the Pacific Northwest Pipeline Co. to consumers in the northwestern States. Exploratory drilling resulted in a new gasfield (Opal), which flowed 1.2 million cubic feet a day from the Second Frontier formation. A new producing horizon was found at the Green River Bend field, where the discovery well flowed 1.4 million cubic feet of gas and 31 barrels of oil a day from the Frontier formation. Of 11 development wells completed, 8 were gas producers in the LaBarge area. Coal production from the No. 8 Brilliant underground mine and the Elkol strip mine, both operated by the Kemmerer Coal Co., declined 29 percent, compared with 1958.

Natrona.—Petroleum production from 25 fields increased slightly over that of 1958 and represented 96 percent of the total value of mineral output in the county. Major producing fields were Salt Creek with 5.1 million barrels, Grieve Unit with 3.2 million barrels, and Salt Creek-E with 1.3 million barrels. Exploratory drilling resulted in 2 oil discoveries and 1 gas discovery from 30 completed wells. At the North Spindletop field the discovery well pumped 102 barrels of oil a day from the Ervay Tongue (Phosphoria) formation, and the discovery well at the Waltman field flowed 200 barrels of oil a day from the Lance formation. The Cooper Reservoir field flowed 8 million cubic feet of gas a day from the Fort Union formation. Development drilling was distributed rather evenly over all fields in the county, and of 57 wells completed, 28 were oil wells and 4 were gas. Pan American Petroleum Corp. operated its absorption plant at Midwest, and residual gas was marketed to consumers through pipelines of Northern Utilities Co. Refineries of The Texas Co., Socony-Mobil Co., and Standard Oil Co. of Indiana operated at Casper throughout the year; throughput was 15.9 million barrels, a 15-percent increase over 1958.

Uranium ore produced at seven mines was substantially greater than that of 1958. The major producers were Globe Mining Co. at the Al job group and Federal-Radorock-Gas Hills Partners at the Buss A and Tee mines. Completion of the 492-ton-per-day processing plant by Globe Mining Co. in December provided milling facilities for that area of the Gas Hills.

Bentonite produced and processed by Benton Clay Co. was the principal nonmetal. The company operated a grinding plant at Casper using company-mined bentonite from Johnson and Natrona County pits. James W. Strait produced a small quantity of hand-cobbed beryllium concentrate from the Casper Mountain pegmatite. Feldspar was produced from this deposit in 1958, but not in 1959.

Niobrara.—Petroleum (from nine fields) was the only mineral produced in the county, and output was 22 percent below that of 1958. Major producing fields were Lance Creek, Lance Creek-E, and Little Buck Creek. A new producing horizon was found at the Mule Creek-W field, where a small quantity of oil was produced from the Lakota formation. C & H Refinery Co. operated its 175-barrel-per-day refinery at Lusk; throughput was 13 percent greater than in 1958. Ohio Oil Co. operated its 5-million-cubic-feet-per-day absorption plant at Lance Creek with a throughput that averaged 3.2 million cubic feet per day with the recovery of 18.1 thousand gallons of natural-gas liquids.

Park.—Park County led the State in the production of petroleum. Output, from 23 fields, was 22 percent of the State total. Production was 28 million barrels, an increase of 5 percent over 1958. The county had one discovery in the Big Horn basin, the T-E Ranch field. The discovery well, completed in October, pumped 249 barrels of oil a day from the Upper Phosphoria formation. Major producing fields were Elk Basin with 16.3 million barrels, Oregon Basin with 5.1 million barrels, Frannie with 2.6 million barrels, and Fourbear with 1.7 million barrels. Development drilling resulted in 15 new producing wells in the Elk Basin field, 11 in the Madison formation, and 4 in the Frontier formation. Eleven new producers completed in the Fourbear field extended the producing area 1 to 2 miles to the southeast. A deep test in the field failed to show commercial oil below the Tensleep formation. There was a significant stepout in the Big Polecat field; the well, 2 miles southeast of Tensleep production, pumped 364 barrels of oil a day and flowed 1.9 million cubic feet of gas a day from the Frontier formation. A north offset pumped 400 barrels of oil a day from the Tensleep formation. Development to the west was scheduled for 1960. Texaco, Inc., operated its natural-gas plant in the Silvertip field and recovered elemental sulfur as well as natural-gas liquids. Pan American Petroleum Corp. operated its Elk Basin absorption plant with a throughput that averaged 13 million cubic feet of gas a day with the recovery of 69,600 gallons of natural-gas liquids. Husky Oil Co. operated its 5,500-barrel-a-day refinery at Cody and began a modernization program designed to increase daily capacity to 9,000 barrels a day. Throughput was 2.2 million barrels, a 12-percent gain over 1958.

Platte.—The Colorado Fuel and Iron Corp. operated its Sunrise underground iron mine from January to July 15 when it was idled because of the nationwide steel strike. Operations were resumed in November. Employment at the mine averaged 275 men. Improvements to the mine consisted of an addition to the heating plant at the main shaft and deepening of the main hoisting shaft, according to the Annual Report of the State Inspector of Mines of Wyoming.

Sheridan.—Petroleum and coal represented 94 percent of the value of all mineral production in the county. Petroleum production from the Ash Creek-S and Ash Creek fields was 12 percent below that of 1958. Four exploratory wells completed during the year were failures. Coal production at the Big Horn No. 1 and Welch strip mines increased 4 percent over 1958.

Sheridan Press Brick & Tile Co. mined miscellaneous clay or shale for use at its Sheridan brick plant. Tongue River Stone Co. mined scoria from a deposit near Sheridan for use as railroad ballast.

Sublette.—Petroleum and natural gas represented nearly all mineral production in the county. Petroleum production from five fields was 5 percent greater than in 1958. Natural gas was produced at the La Barge, Big Piney, Dry Piney, and Hogsback fields. Of 20 exploratory wells completed, 7 were gas discoveries. The discovery well at the Figure Four Canyon field, completed in July, flowed 18 million cubic feet of gas a day from the Frontier formation. A well in the East La Barge area, later reclassified as a part of the La Barge field, flowed 8.1 million cubic feet of gas a day from the Second Frontier formation. Other discovery wells flowed 1 to 5 million cubic feet a day from Fort Union, Lance, Second Frontier, and Muddy formations. Of 64 development wells completed, 22 were oil and 32 gas wells, most in the Big Piney-La Barge area, where 34 new producers were completed, in the Hogsback field with 4 new producers, and the Tip Top with 5 new producers.

Uranium ore produced by South Pass, Inc., at the Pard No. 4 mine was shipped to Riverton for treatment.

Sweetwater.—Petroleum and coal represented 50 percent of the value of all mineral production in the county. Petroleum output from nine fields—the major ones being Lost Soldier, Table Rock, and Canyon Creek—was 12 percent below that of 1958. From 42 exploratory wells completed, there were 3 oil discoveries and 5 gas discoveries. The most important oil discoveries were the Patrick Draw and Desert Spring-W fields. The discovery well at the Patrick Draw field, completed in November, flowed 637 barrels of oil a day from the Almond formation; and the discovery well at the Desert Springs-W field, completed the same month, flowed 300 barrels of oil a day, also from the Almond formation. The third discovery, Little Worm Creek, pumped 40 barrels of oil a day from the Morrison formation. Of the gas discoveries, the most outstanding was the Arch field, discovered in April about midway between the Desert Springs (a 1959 discovery) and the Table Rock fields. The discovery well was completed with a flow of 15 million cubic feet a day from the Almond formation. Following this discovery, a well 6 miles west of the Desert Springs field, completed in May, flowed 9.2 million cubic feet of gas a day from the Almond formation. A third gas well, State Line, discovered in September, flowed 9.2 million cubic feet a day from the Wasatch formation. A second well in the field flowed 3 million cubic feet of gas a day from the Fort Union formation. Other discoveries were the Pioneer field well that flowed 2.5 million cubic feet of gas a day from the Almond formation and Joyce Creek that pumped 25 barrels of oil a day from the Dakota formation. Development drilling resulted in producing wells in the Desert Springs and Trail fields.

Sinclair Oil & Gas Co. operated its natural-gas compressor plant at Bairoil with a throughput that averaged 9 million cubic feet of gas a day with the recovery of 10,000 gallons of natural gasoline.

Coal production was 11 percent below that of 1958. Mines active were Rock Springs No. 8 and Superior D. O. Clark mines operated by the Union Pacific Coal Co.; Rainbow Nos. 6 and 7 mines operated by the Gunn-Quealy Coal Co.; and the Swanson mine operated by the Swanson Mining Co.

Uranium ore produced at the Marcy group by North Elk Mining Co. was shipped to New Mexico for treatment.

A 26-percent increase in the output of soda ash produced from trona by Intermountain Chemical Co. was reported. This commodity provided a large portion of the county's mineral income.

Uinta.—Petroleum production, from two fields, was 64 percent greater than in 1958. Petroleum was mostly condensate from the Church Buttes field, primarily a gasfield. Four exploratory wells were failures, and there was no development drilling. Natural gas from the Church Buttes field was processed by Mountain Fuel Supply Co. at its 100-million-cubic-foot-per-day absorption plant at the field. Throughput averaged 55 million cubic feet a day from which 1,000 gallons of natural-gas liquids was recovered.

Washakie.—Petroleum production, from 11 fields, was 39 percent below that of 1958. Major producing fields were Cottonwood Creek, Worland, Slick Creek, and Hidden Dome. Seven exploratory wells were failures. Of 13 development wells completed, 8 were oil wells. Pan American Petroleum Corp. operated its natural-gas plant in the Cottonwood Creek field for the recovery of natural-gas liquids and elemental sulfur. Pure Oil Co. operated its 60-million-cubic-foot-per-day absorption plant at Worland; average throughput was 53 million cubic feet a day with a recovery of 72,000 gallons of natural-gas liquids. Residual gas from the plant was further processed by Texas Gulf Sulphur Co. for the recovery of elemental sulfur.

Weston.—Petroleum production, from 11 fields, was 10 percent below that of 1958. Petroleum production represented 83 percent of the value of all mineral output in the county. Major producing fields were Clareton, Skull Creek, and Fiddler Creek. Exploratory drilling resulted in establishing new producing horizons in the Lodgepole Creek and Lonetree Creek fields. The Lodgepole Creek discovery flowed 130 barrels of oil a day from the Newcastle formation and the Lonetree Creek discovery flowed 145 barrels of oil a day, also from the Newcastle formation. Another discovery, reclassified as a part of the Lonetree Creek field, flowed 220 barrels of oil a day from the

Newcastle formation and extended the field 2 miles to the west. Development drilling included work in the Osage field on the northeast end of the Clareton trend, where 22 new oil producers were completed, and in the Lodgepole Creek and Lonetree Creek fields on the southwestern end of the trend. Other development drilling was done at the Brooks Ranch field, where nine new oil wells producing from the Frontier formation were completed. Wyton Oil Co. operated its 5.5-million-cubic-feet-a-day natural-gasoline plant at Newcastle. Sioux Oil Co. operated its 6,000-barrel-per-day refinery at Newcastle with a throughput of 1.7 million barrels, a 20-percent increase over that of 1958.

Bentonite mines and mills were operated by American Colloid Co., Archer-Daniels-Midland Co., and Natural Lead Co.; output was 12 percent above 1958.

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